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NEW AFC CIRCUITS DESCRIBED

Beijing DIANZI KEXUE JISHU [ELECTRONIC SCIENCE & TECHNOLOGY] in Chinese Vol 16, No 7, 10 Jul 86 pp 19-21

[Article by Chen Zhiheng [7115 1807 1854], Institute No 36, Ministry of Electronics Industry: "Analog-Digital Hybrid Automatic Frequency Control"]

[Text] There have been many schemes for achieving automatic frequency control, but there are many deficiencies in the common schemes of detuned circuit frequency discriminators and phase-locked loops, which cannot satisfy the requirements of high precision. We introduce in this paper a new scheme for automatic frequency control, namely, the analog-digital hybrid scheme. In comparison with the two aforementioned schemes, it has the advantages of:

1. being quick to control, and having a broad pull-in range;

2. there can be automatic frequency control whether for carrier wave signals or for already demodulated signals, where that control function is accurate, reliable, and without erroneous locking;

3. theoretically speaking, this scheme is an error free control system, where as long as there is a frequency differential of af_da, fine tuning will continue until $af_da=0$, so control precision is quite high;

4. there is no aLCa loop, and the majority of components are digital circuits, so the temperature characteristics are much more optimum than for the detuned circuit frequency discriminator.

Working Principles:

The secondary IF signal $af_{IF}a$ passes through limiting amplification and shaping to become a pulse signal, then goes through a secondary ÷ 10 circuit, where a 10.7 MHz IF signal becomes a 107 kHz signal. This signal is divided into two circuits, where one circuit goes through a phase shifter to shift the phase a-bp/4a, and then enter the mixer I. The other circuit passes through a phase shifter to shift the phase a+bp/4a, and then enter mixer II. This is the working process for channel A.

The 10.7 MHz signal put out by the reference crystal oscillator goes through a similar shaping, frequency division, and filtering, to obtain signal $af_r a$ output to mixers I and II. The signal after mixing goes through detection to obtain the slip frequencies aD_1a and aD_2a.

Because signal $af_{IF}a$ has already divided into two signals $af_{IF1}a$ and $af_{IF2}a$ with phase differentials of ab+bp/4a before mixing, these two slip frequency signals of phase differential abp/2a are amplified, detected, and shaped within each channel, and converted into square waves.

The envelope after detection can be approximately expressed by the following formula:

$$aD_1=A \text{ asin } a(2bpf_{dt}a+abQ)a$$

$$aD_2=A \text{ acos } a(2bpf_{dt}a+abQ)a$$

where the phase differentials for aD_1a and aD_2a are abp/2a, and where abQa is the initial phase when at=0a. $af_d=f_{IF}-f_r a$, the value of which may be positive or negative. aD_1a is the sine function, changing as the sign of $af_d a$ changes, that is, the sign of aD_1a changes, signifying that its phase has changed abpa (GU) degrees. aD_2a is the cosine function, a signal that does not change with changes in $af_d a$, and that therefore may serve as a reference phase. The polarity of aD_1a may be determined by the changes in the sign of $af_d a$. This is why the signal $af_d a$ is divided into two orthogonal signals.

After shaping, the signals aD_1a and aD_2a change into square waves. When the two square waves are added to a 4-bit one from two data selector under the control of the electronic switch I, and when this causes the slip frequency $af_d a \geq 25$ kHz, this is directly added to a pulse phase detector for phase detection. If the slip frequency $af_d a < 25$ kHz, and the input signal is also an angle modulated signal with a very large modulation exponent, then the modulation effect will be very serious and the phase detector cannot operate normally, in which case there cannot be automatic frequency control.

To eliminate the modulation and noise components and broaden the pull-in range, when the slip frequency $af_d a < 25$ kHz, the signal is first sent to a bandwidth detector and a stretcher, and is then input to a pulse phase detector. This process occurs automatically through circuits.

The two signals that have been processed by the bandwidth detector and the stretcher can easily generate asymmetry. To expand the pull-in bandwidth, when the frequency differential $af_d a$ is larger (i.e., $af_d a \geq 25$ kHz) and the effects of modulation are less, the signal is directly sent to the pulse phase detector and does not pass through the bandwidth detector and stretcher. Regarding the size of the slip frequency $af_d a$, the control circuits can automatically determine this and accurately handle it.

The PN pulse output by the pulse phase detector is on one circuit sent to the NAND gate YF, producing the pulse CP through the A terminal; the other circuit sends to the $Sb-_D$ and $Rb-_D$ terminals of the JK flip-flop, to obtain the positive/negative control signal through terminal B. At the same time, these

two signals are sent to the frequency synthesizer of the receiver. Whether the frequency differential $af_da > 0$ or $af_da < 0$ causes the local oscillator frequency to drop or rise correspondingly, consequently allowing the receiver to accurately trace the external signal.

Rapidly changing demodulation components have seriously interfered with the normal performance of AFC. If this cannot be eliminated to the greatest degree, then accurate PN pulses cannot be generated, and therefore overcoming the effects of demodulation is a very crucial problem. The primary means to do this are: limiting, frequency division, filtering, and pulse bandwidth detection.

Below, we stress the pulse bandwidth detection method, which is to send the square pulse after frequency division and filtering to the pulse bandwidth detector for bandwidth detection processing, filtering out non-prescribed pulses.

Input pulses of different amplitudes and bandwidths are first sent to shaping circuits to make them keep the same pulse width and amplitude as the originals, as shown in figure 3 aU_Ba. Then sending aU_Ba to a saw-tooth wave generator, where the charging period of the saw-tooth wave generator is determined by the pulse bandwidth, and therefore, as the pulse width broadens, the charging period lengthens, and the saw-tooth wave crest value that is output is greater; conversely, the shorter the charging period, the less the value of the output crest, as shown in aU_Ca. Again through the pulse amplitude detector, signals with amplitude less than aU_ma are not output, thereupon obtaining the wave form as shown for aU_Da.

It can be seen from the wave-form shown in figure 3 that because demodulation or noise the front and rear rims of the pulses have many non-prescribed narrow pulses, which is the rapid drift component created by demodulation and noise. By passing through the pulse bandwidth detector, this goal of eliminating these pulses may be met.

The process of generating PN pulses will be abridged here due to limitations of space, but we should emphatically point out the following characteristics of PN pulses:

1. PN pulse recurrent frequencies should be corrected in relation to the slip frequency af_da;

2. when $af_da > 0$, i.e., when the second IF signal is higher than the reference frequency af_ra, that should generate the N pulse, causing the reversible counter of the frequency synthesizer to begin subtracting, causing the receiver local oscillator frequency to drop, which can result in $af_dab>"0"$;

3. when $af_d a < 0$, i.e., when the second IF is lower than the reference af_ra, this should generate the pulse P, causing the reversible counter to begin adding, in this way causing the local oscillator frequency to rise and $af_dab>"0"$;

4. for arbitrary transients while AFC is in operation, it is not permitted that at the same time there be P and N pulses, and when $af_{da}=0$, there are never PN pulses (at this time, the periods for PN pulses change to infinity).

Experiments have shown that this scheme can effectively carry out automatic frequency control, whether on carrier wave signals or for AM, FM, or phase modulated signals, as well as for double modulated signals, and moreover that this is quick, the pull-in range is broadened, and control is more precise. The designed circuits have been tested overall, routine testing has been carried out, and satisfactory results have been obtained, and they have been technically appraised throughout.

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STUDY OF IONOSPHERIC EFFECTS OF A NUCLEAR EXPLOSION OBSERVED AT LONG RANGE USING HF BACKSCATTER TECHNIQUE

Beijing DIQIU WULI XUEBAO [ACTA GEOPHYSICA SINICA] in Chinese Vol 29, No 5, Sep 86 pp 425-431

[Article by Jiao Peinan [3542 1014 0589] of the Chinese Research Institute of Radio Wave Propagation, Xinxiang; originally received 28 August 1985; revised manuscript received 24 February 1986; first paragrapn is source-supplied abstract]

[Text] Abstract: This article describes the results of the ionospheric effects of one of our 1976 large equivalent lower-atmosphere nuclear explosions measured using high frequency (HF) backscattering techniques. The high frequency backscattering measuring equipment was installed at Xinxiang, 2205 km from the blast. This article obtains the parameters for the additional ionized zone and ionospheric disturbances produced by the nuclear explosion. These results match those of other means of observation in the vicinity of the blast zone.

I. Introduction

The mechanism of high frequency backscattering was discovered in the 1940's and people quickly conceived that it could be used as a means to observe the ionosphere. Recently, due to advances in the techniques of high power broad band transmitters, weak signal information extraction, and broad band short-wave phase space electronic antenna arrays, high frequency backscatter technology very much has the hope of developing into a more economic and very effective means for super distant environmental or target measuring. This article describes the possibility of using this technique and analysis of experimental results in measuring the ionospheric effect of distant lower-atmosphere nuclear blasts.

Nuclear explosions are a huge source of artificial disturbance with regard to the ionosphere. Lower-atmosphere nuclear explosions have an influence on the ionosphere. For the most part this takes two forms: The severe shock wave produced by nuclear explosions cause the higher strata of the atmosphere to form acoustic-gravity waves disturbing the ionosphere. And delayed gamma rays interact with the atmosphere forming an additional ionization zone in the D zone of the ionosphere. To monitor these two

effects many have used ionosphere vertical detectors, cosmic noise detectors, high frequency continuous wave Doppler equipment, etc. to carry out measurements, obtaining many research results [1-5, 7]. However, the use of high frequency backscatter detection methods to do research is not often seen.

In addition to ourselves, for the Chinese nuclear explosion of 1976, colleagues from Wuhan University also set up a station in the vicinity of the blast zone and used high frequency backscatter measurement, also obtaining valuable results on the ionospheric effects. For this article we used high frequency backscatter techniques at a station set up at 2205 km, far removed from the blast point and beyond sight of the blast and observed the ionospheric effects of this nuclear explosion. The results obtained through our analysis tally well with those observations from vertical sensing near the blast zone, cosmic noise sensing, and local high frequency backscatter. Moreover we give an explanation of the disturbance form of the leading edge of the backscattered echo. This demonstrates the practical possibilities of using backscatter techniques beyond visual ranges to detect the effect of nuclear explosions on the ionosphere.

II. Experimental Conditions

1. Observation Equipment

The observed event was a large equivalent lower-atmosphere nuclear explosion done in 1976 in the western region of China. The detection station was set up in Xinxiang, 2205 km from the blast site. The equipment was an advanced model backscattering instrument equivalent to a shortwave radar. During observations we used a frequency of 18.13 MHz, transmitted pulse power of 10.8 kW, pulse width of 100 μs, and a repeat frequency of 30 Hz. The transmitter antenna was a РГ(65/4)1 rhombic antenna and the receiving antenna was a ДРГ(65/4)1 double rhombic antenna. The total gain of the receiving antenna was 32 dB with a horizontal beam width of 12° and an angle of elevation of 10° for the principle lobe center. The antenna was positioned directly toward the test zone. The experiment recorder was an A model scope amplitude versus time delay graph. We used a motion picture camera for single shot exposures at intervals of 0.5, 1, and 3 seconds between exposures. Beginning from 15 minutes before the blast we photographed continuously for over 3 hours, obtaining a total of over 6,000 exposures.

At the western edge of the blast site, the 20 km position (2225 km from the observation station) was installed a 150 W responder. It responded with the same frequency as the backscatterer to standardize the oblique distance corresponding to that point with known surface distance and consequently calculate the ionosphere's equivalent reflection virtual height. The responder had a 0.5 ms system delay to avoid system self-excitation. Calculations of the standard distance must deduct this interval.

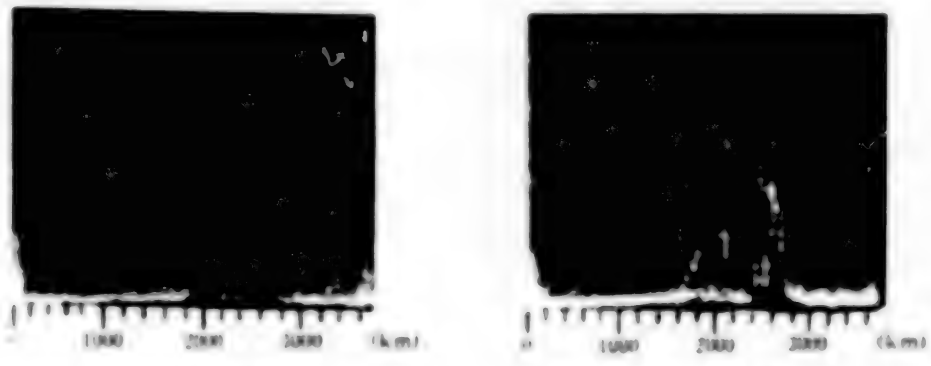
2. Observation Results

(1) Oblique distance standardization of the blast point. In order to ensure that the detection beam would cover the additional ionization zone formed

after the blast, the operating frequency was selected to be 18.13 MHz. This way the oblique distance range covered by the beam was 1800 to 3000 km. The echo oblique distance reading of the responder in the vicinity of the blast site was 2400 km. Deducting the 75 km fixed time interval caused by the responder's own time delay the oblique distance of the 2225 km responder was 2325 km, the difference between surface and oblique distance was 100 km, and calculation obtained the ionosphere's equivalent virtual height as about 257 km. From this we knew that a surface distance of 2205 km of the blast site corresponded to an oblique distance of 2305 km.

(2) Echo amplitude standardization. Using a standard signal source compared to the echo amplitude the blast zone echo amplitude before the blast was 15.5 dB (1 μV = 0 dB).

(3) Echo amplitude during the blast and changes in the leading edge. In that portion of the central blast zone standardized by the responder, the echo after the blast (after zero time), inside 10 minutes, experienced very great attenuation. At its most severe, the portion echoed was lost below the noise with a relative change in amplitude of over 12.5 dB. At this time the noise level was 3 dB. Figure 1 shows photographs 1 minute before and 2 minutes after the blast.



(a) 1 minute before (b) 2 minutes after

Figure 1. Photographs of the backscattered echoes before and after the blast

From 53 minutes to 67 minutes and from 95 minutes to 102 minutes after zero time the entire echo was lost.

The leading edge of the echo (smallest oblique distance) within 50 minutes after zero time was relatively stable, but after 51 minutes it began to display sinusoidal type oscillatory changes as shown by the solid line in Figure 2b.

Three hours and 10 minutes after the blast, the echo shape was restored to its pre-blast state, the entire process taking 190 minutes.

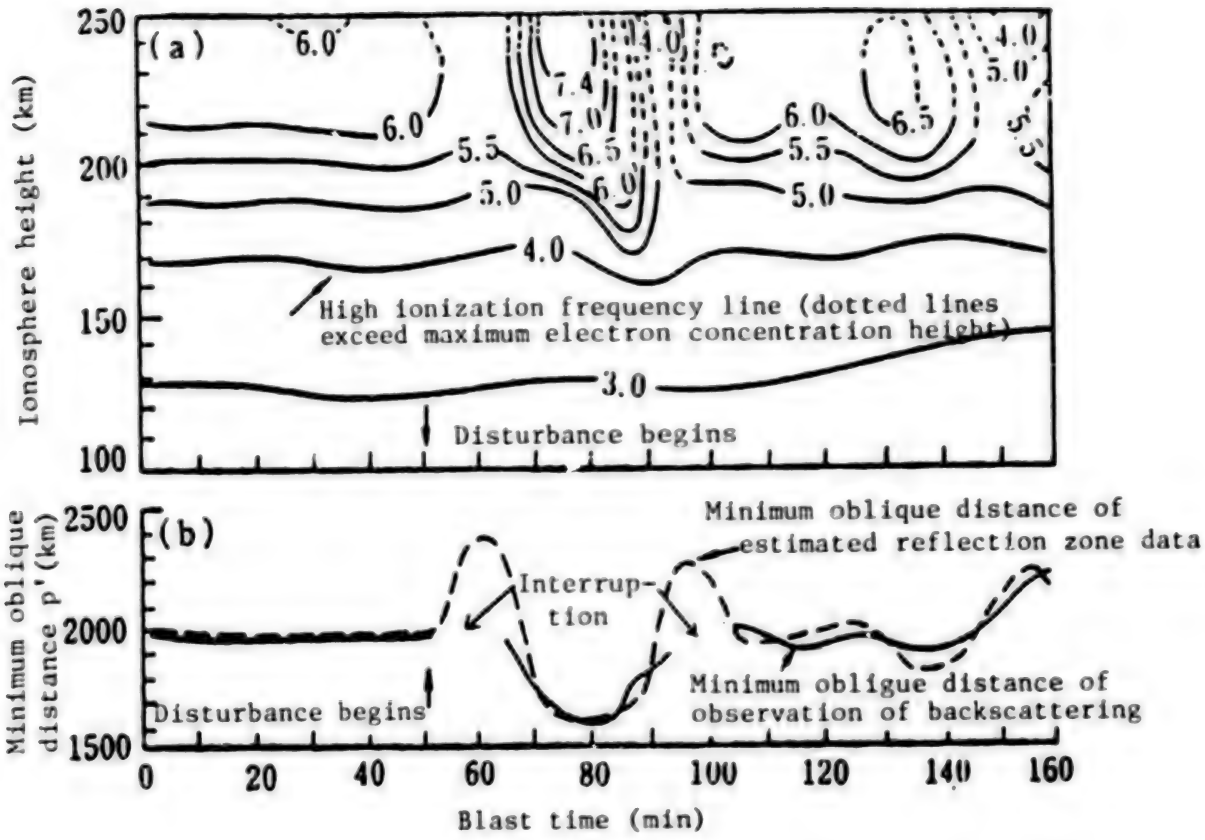


Figure 2. Changes in minimum oblique distance of backscattered echoes (b) and their disturbance of reflection zone ionosphere (a)

III. Analysis of Detection Results

1. Analysis of the State of the Leading Edge of the Backscattered Echo

In the process of observing the effect of the nuclear explosion on the ionosphere, there appeared a unique phenomena in the leading edge of the backscattered echo: The leading edge (minimum oblique distance) within 50 minutes after zero time was maintained without change, but after 51 minutes exhibited a sinusoidal type oscillatory change. The various ionospheric vertical observation stations beginning at different times also showed periodic oscillation in their critical frequency f^0F_2. Row [3] has used acoustic-gravity wave theory to explain the oscillation state of f^0F_2 caused by nuclear explosions. Xi Dipang has used Row's theory to carry out an analysis of the vertical detection results for this particular experiment. (Footnote 1) (Xi Dipang, "Effects of Nuclear Explosions on the Ionosphere," Collection of the 1979 Radio Propagation Academic Conference (1980), pp 133-152)

In order to study the relationship between oscillatory changes in the echo's leading edge and the disturbed conditions of the ionosphere, we computed changes in the electron concentration cross section of the reflection zone

corresponding to the leading edge of the echo in the nuclear explosion process and its relative radio wave propagation path. Based on estimates of the echo's leading edge, the reflection zone was about 800 km from the observation point and about 1400 km from the blast point. The reflection zone was about 250 km northeast of the Lanzhou ionosphere station with a latitude difference of 1.4°. Here we chose the Lanzhou vertical observation data as ion[illegible]ic data for the reflection zone and had to correct for 6 minutes of t[illegible] Actually, it was 44.7 minutes after zero time when Lanzhou observed the f^0F_2 disturbance while the disturbance of the echo's leading edge was observed in the backscattering 51 minutes after zero time, the two being 6.3 minutes apart, tallying rather well. This article adopts the method proposed by Liang Liping et al. to get the electron concentration cross section from monthly reported parameters on ionospheric characteristics. (Footnote 2) (Liang Liping, "Using Ionosph[illegible]e Characteristic Parameters To Obtain Electron Concentration Cross Sections," RADIO WAVES AND ANTENNAS, 1 (1984), pp 40-51) Then with respect to a frequency height chart of the reflection zone getting a reflection zone ionospheric disturbance image and cross section parameters of its var[illegible]ous moments as shown in Figure 2a. From the figure we can see that this experiment caused a rapidly beginning traveling wave type disturbance.

In order to compute the group delay of the echo's leading edge we use the standard parabolic form formula for ionosphere backscattering group delay as [8]

$$P = 2\left\{R_\phi \sin\beta - R_0 \sin\alpha - \frac{1}{A}\left[R_\phi \sin\beta + \frac{B}{4\sqrt{A}} \ln \frac{B^2 - 4AC}{(2AR_\phi + B + 2R_\phi\sqrt{A}\sin\beta)^2}\right]\right\}. \tag{1}$$

where

$$A = 1 - \frac{1}{F^2} + \left(\frac{R_\phi}{FY_m}\right)^2, \quad B = (-2R_m R_0^2)/(FY_m)^2,$$

$$C = -(R_m B/2 + R_0^2 \cos\beta), \quad R_m = R_0 + h_m, \quad R_\phi = R_0 + h_0,$$

$$F = f/f^0F_2, \quad \beta = 90 - \varphi, \quad \cos\alpha = \frac{R_\phi \cos\beta}{R_0}.$$

Here, h_m is maximum electron concentration height, Y_m is the semi thickness of the strata, f is the operating frequency, R_0 is the radius of the earth, h_0 is the height of the bottom of the ionosphere, α is the ray angle, and φ is the entry angle of the ray with respect to the strata.

Taking the derivative of (1), with respect to sin β, and setting it equal to zero we obtain the equation for the minimum group time delay. If given a set (for a certain time) of cross section parameters h_m, Y_m, and f^0F_2 and applying the substitution method then we can solve obtaining a ray angle of elevation $\alpha_{P_{min}}$ corresponding to the minimum group delay time. Then

substituting this value in (1), using the original set of parameters we can get the minimum group path P_{min} of the said operating frequency, f. Results of these computations are shown using points and lines in Figure 2b. From the figure we can see computed results tally rather well with observed results. Consequently it can be affirmed that ionospheric traveling wave disturbances will cause sinusoidal type periodic oscillatory changes to occur in the leading edge of backscattering.

Note in Figure 2 that the two times when the backscattered echo disappears come just at the positive half cycle of the sinusoidal oscillation and, moreover, that both times correspond to the times of concentration "valleys" in the ionosphere electron concentration disturbance. Although the maximum electron concentration height of the later concentration "valley" is lower than the previous one, the electron concentration is nevertheless even lower than the previous one. When the ionosphere electron concentration is abruptly lower it makes the fixed frequency radio waves refract to ever farther distances. But the energy of the low concentration ionosphere reflected radio wave is obviously weak. Adding in that the dissipation of the backscattered propagation path is much greater than the single pass propagation dissipation it makes it so that the backscattered echo cannot be detected by the equipment and is lost.

From observations and computational results we can estimate the propagation speed in the ionosphere of the acoustic echo traveling wave disturbance caused by the shock wave of this blast to be $\overline{V} = S/t_0 = 1400$ km/51 min = 458 m/s. The wave length of the traveling wave disturbance was about 102 km, the disturbance's height was in the area of 230 km, and the disturbance amplitude was about 40 km. The propagation speed of the disturbance and the observation results of the vertical observing stations matched up. This is shown in Table 1.

Table 1. Propagation Speed of the Disturbance in the Ionosphere

Observation	Station name	Distance from blast (km) (leading edge reflection zone)	Beginning of disturbance (min)	Disturbance propagation speed (m/s)
Backscattering	Xinxiang	1400	51	458
	Lasa (Linshi)	1260	43.4	484
Ionospheric	Lanzhou	1300	44.7	485
vertical	Chongqing	1950	65.9	493
detection	Beijing	2200	74.5	492
	Wuchang	2450	85.1	480
	Guangzhou	2930	98.3	496

Note: Vertical observation results are from Xi Dipang's article.

2. Size Estimate of the Added Ionization Zone

According to backscattered echo A type records and antenna beam computations, the longitudinal surface distance covered by the beam was 1700-2900 km and the transverse width was 460 km. The blast region was entirely within the zone covered by the beam. When the central region of the blast formed an additional ionization zone, the low traveling radio wave detected by the backscattering twice passed through the additional ionization zone and necessarily severely absorbed. Consequently, the strength of the corresponding part of the echo was weakened or even lost. This sort of phenomena was indeed clearly observed in the first 10 minutes after zero time, see Figure 1b. This phenomena of partial echo loss of the backscattered echo is different from the mechanism of complete loss mentioned earlier.

Measuring the size of the region of obvious weakening or loss of the echo and using the 100 km oblique and surface distance difference standardized by the responder to make corrections we could get an estimated value for the size of the additional ionization zone. In measuring we took a data average (from about 120 values) from 2 minutes in the first 10 after zero time. The reading error was 50 km. Figure 3 gives the size of the additional ionization zone and its change over time. The solid line in the figure is the near observation results of Wuhan University's Guan Rongsheng et al. The two are about the same.

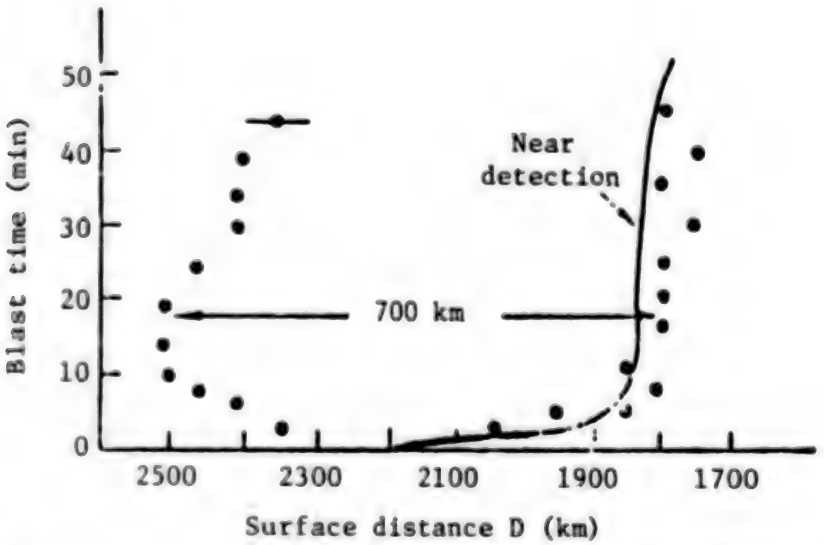


Figure 3. Additional ionization zone and its change over time

Fifty-one minutes after zero time the ionosphere in the detection circuit reflection area was already disturbed by acoustic-gravity waves recording the effect of the superimposed disturbance and there was no good in doing estimates of the additional ionization zone changes. From Figure 3 we can estimate the maximum longitudinal range of the additional ionization zone with respect to the observation station to be around 700 km attaining this

value at about 10 minutes. Table 2 gives time and radius for the maximum expansion of the additional ionization zone detected using different observation methods for this blast.

Table 2. Additional Ionization Zone Sizes Detected by Each Observation Method

Item \ Method / Data	Cosmic noise measurement	Vertical detection	High frequency communications	Near backscattering	Long distance backscattering
Time of maximum expansion (min)	9	?	5	8	10
Maximum radius (km)	350	>270	400	360	350

Note: The left three items are from Wu Lei's technical report and the fourth item is cited from the technical report of Guan Rongsheng et al.

3. Estimate of the Average Ionization Concentration of the Additional Ionization Zone

Usually for the absorption of radio waves in the ionosphere we can use the non-deviative absorption formula [6]

$$L = 8.68 \int k ds \quad \text{(dB)} \tag{2}$$

for estimates, in which

$$k = 5.3 \times 10^3 N\nu/(\omega^2 + \nu^2) \quad \text{(dB/km)}. \tag{3}$$

Consequently, from the measured absorption value the electron concentration can be roughly predicted. The backscattering observed that, after the blast produced an additional ionization zone, the quantity of radio wave attenuation compared to when there was no additional ionization zone increased 12.5 dB or $\Delta L = 12.5$ dB. So from (2) we can derive the electron concentration ΔN which is added to the background electron concentration N_0. In this way, the electron concentration of the additional ionization zone can be sought.

From formula (2), considering the situation of obliquely projected rays, we have

$$\Delta L = 4.6 \times 10^4 \frac{\Delta N \cdot \nu \cdot \sec\varphi}{\omega^2 + \nu^2} \int dh \quad \text{(dB)}. \tag{4}$$

in which ΔL is the radio wave attenuation dB value relative to there being no additional ionization zone; φ is the entry angle into the 72 km strata of the oblique ray, ω is the radio wave frequency; ν is the collision frequency,

ds and dh respectively are the path units and height units. The integrated path with respect to the backscattered propagation is two passes through the additional ionization zone.

It is generally believed that the maximum height of the maximum electron concentration of the additional ionization zone is about 72 km but with regard to absorption, the height range that must be used is about 10 km. For this height, the upper collision frequency is 10^6 hits/s. Judging the backscattering to be type 1F type propagation and for a blast point with a surface distance of 2205 km, the oblique distance is 2305 km, giving the entry angle as 72.2° whereupon the path length of the major absorption zone for two passes through the additional ionization zone, s is 65.4 km. The operating frequency is 18.1 MHz, satisfying the condition $\omega^2 >> \nu^2$. Taking this data and substituting in another form of formula (4)

$$\Delta N = 8.6 \times 10^4 \frac{\nu}{f} \Delta L \qquad (\mathrm{cm}^{-3}), \tag{5}$$

giving the electron concentration of the additional ionization zone $\Delta N = 5.4 \times 10^4$ cm^{-3}. This is one order of magnitude larger than the background electron concentration of the D strata magnitude.

According to results of cosmic noise detection for this nuclear experiment, 2 minutes after zero time the additional electron concentration of the blast's central zone can reach 10^6 cm^{-3}; 5 to 25 minutes after zero time, in a range with a 200 km radius, the concentration of the additional ionization zone is not lower than 10^4 cm^{-3}, at the blast center it reaches 5×10^4 cm^{-3}, while it is gradually lower in the boundary region. Over time the entire additional ionization zone gradually dissipates, so we can see that the results obtained by these two methods are relatively the same. However, the area covered by the long distance backscattering beam is very big so the resolution is more lacking and it can only provide an estimate of the average concentration over the large area of the absorption zone.

IV. Conclusion

Utilizing high frequency backscattering techniques, from a station 2200 km away, we observed the ionospheric effect of a 1976 Chinese large equivalent lower-atmosphere nuclear explosion. Our observation results matched those of other methods in the blast zone vicinity. Experimental studies show this sort of remote detection technique has practical application possibilities for detecting the effect of nuclear explosions on the ionosphere.

The additional ionization zone produced by the nuclear blast caused the corresponding portion of the backscattered echo to experience severe attenuation. From the size and range of the attenuation of this echo we estimated the dimensions and electron concentration of the additional ionization zone.

The shock wave of the nuclear blast caused the upper atmosphere to form acoustic-gravity waves which make a traveling wave type disturbance appear in the ionosphere. This form of disturbance causes the minimum group time delay of the backscattered echo to produce sinusoidal periodic changes. From the disturbance curve of the minimum time delay we can derive the propagation speed of the disturbances and other parameters.

Hu Yunchun, Qin Bogen, the late Xing Caisheng, Zhu Qiguang, Huang Deyao, Zhu Taiping, and Yang Cuiyun participated in the observation experiment. For comparison observation results we used related research conclusions of Wu Wei, Xi Dipang, and Guan Rongsheng. We express our sincere gratitude to them all.

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NETWORKING EQUIPMENT PRODUCTION TECHNOLOGY IMPORTED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 pp 11-12

[Article by Fu Dongchao [0265 2639 6389], Tianjin Municipal Economics Commission: "Production Technology and Key Equipment for Complete Sets of Computer Network Equipment"]

[Text] With the growth of China's computer efforts, the application of computer networks will become ever more widespread. Network equipment is the equipment needed for computers to establish networks and to establish communications connections. This includes network communications transmission equipment, modems of all kinds, network controller equipment (such as various transmission controllers, communications controllers, data collectors, distributors, and multiplexers), and test equipment (such as error coding instruments, analog channel machines, and special test terminals).

The Tianjin Radio Plant No 5 has been determined to be the designated production plant for computer network equipment by the Ministry of Electronics, and was one of the first plants in China to develop and produce a modem in conformance with CCITT (Consultative Committee, International Telegraph and Telephone) standards. They have advantages regarding technology and markets in comparison with similar domestic industries, but there is still a large gap between the products and technology of this plant and those of advanced countries in the world. In addition, they cannot satisfy the demand from the growth of computing in this country.

To allow Tianjin Municipality to become an important production base for microcomputers and network equipment in China, to allow computer network equipment to approach or attain advanced international standards of the 1980's in terms of technology and quality, and to improve the share of domestically produced communications electronics in the domestic market, which will also serve as a base from which to enter international markets, the Tianjin Municipal Radio Plant No 5 has imported from a United States digital communications industrial company (the GDC Company) a complete set of network equipment production technology and primary production equipment.

The primary substance of the importation:

1. They imported the complete design, technical materials, and schematics having to do with production of the V series of modems, together with scientific methods for quality management and production management.

2. They imported the manufacturing programs and major production equipment needed for the CKD packaged debugging production line, which will bring effective quality control to key test points in the production process. And they imported specialized equipment such as wave soldering machines, cleaning machinery, chip extractors, various test stations, and detection equipment, as well as specialized package processing tools.

On the basis of analyses and assimilation of imported advanced technology and of partial nationalization of seven products among them, this plant completed the first stage of nationalization of five products that had been planned earlier, the DC4827, the DC1222EC, the DC2426P, the DC2426S, and the DC321, at the end of 1985. Tests of all technical indices attained the levels of the American GDC Company's similar products, and in addition complied with relevant standards for the CCITT V recommendation for modems.

Primary features:

1. uses microprocessor and LSI technology;

2. front board display of status;

3. has digital loop, far-end digital loop, and analog loop features;

4. has a self-test function;

5. has automatic answer feature;

6. output levels from 0 to 15 dBM, adjustable;

7. delay levels no lower than 2 dB.

During the production process after importation, this plant has diligently studied and used the advanced management means of the American GDC Company, from the screening and testing of components to all installation and debugging procedures, industrial technology personnel and quality inspection personnel have been assigned, and they have worked out production techniques, rectified technical discipline, and have established production source recording and quality cards, and feedback information for tracing product quality.

The production technology and key equipment for complete sets of network equipment that was imported by the Tianjin Municipal Radio Plant No 5 is of an advanced international level, there are markets for this within China, the products and equipment are reliable, and the technology is advanced. These things have good economic results, and technologically and in terms of management, there are many areas worth learning from. This importation project passed its evaluation in June 1986.

12586
CSO: 4008/1078

NEW MICROCOMPUTER LOCAL AREA NETWORK DEVELOPED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 pp 12-13

[Article by Yang Dianchun [2799 3013 2504] of the Office of Achievements, Tianjin Municipal Science and Technology Commission: "The E-Net Microcomputer Local Area Network System"]

[Text] The E-net Chinese-English microcomputer local area network system was developed jointly by the Nankai University Computing and Systems Science Department and the Nankai Technology Development Consulting Company's Institute of Computing Technology, and passed its municipal level technical evaluation on 16 July 1986.

This network system is based on the imported and assimilated EVERNET 25.5 network system, and has been developed in accordance with the demands of actual applications and in light of network functions. This network is being used by units at the Shenyang Heavy Machinery and Equipment Plant, the Ministry of Water Resources and Electric Power Tianjin Academy of Design, and the Shanghai Academy of Mechanics, where it has obtained satisfactory results.

I. Primary Technical Specifications for E-net

1. Network topology: bus

2. Transmission rate: 3 Mb/s

3. Maximum capacity: 254 terminals

4. Transmission distance: 1,200 m

5. Mode of transmission: baseband

6. Access control methods: CSMA/CD CA

7. Error code rate: 1 EXP -17

8. Software overhead: 100K RAM

II. Primary Functions and Features of E-net

1. It can be used with the IBM PC/XT and compatibles, as well as the IBM AT;

2. there is no need for setting up special servers, because each node in the network is equal and may share all resources;

3. under support of the NK Chinese text system or CCDOS, all functions of the network may use Chinese characters, and the main prompts for network operations have been rendered in Chinese for the convenience of users;

4. it has a spooled, queue print function;

5. it has an electronic mail function;

6. it has a broadcast communications function, where messages can be sent to the entire network or to any particular node;

7. the network has three levels of measures for the security of files and subdirectories;

8. if the NK Chinese text system is used, because its character library is not kept in the system, PC's configured with 256K bytes of RAM can support this network. After entry into the network, the network software resident memory can run Chinese-English application programs such as dBASE II, SuperCalc-3, and WordStar; if the user has a PC with 512K bytes of RAM, after entry into the network he may run large Chinese-English application programs such as dBASE III and Lotus 1-2-3;

9. locking and unlocking commands have been developed for dBASE III, which allows dBASE III to be run with multiple users on the network.

III. A Comparison of E-net with the Major Technical Specifications for Some LAN's that Are Currently Available in China:

	E-net	Omninet	Ethernet	K-net
topology	bus	bus	bus	bus
access method	CSMA.CD,CA	CSMA/CA	CSMA/CD	CSMA/CA
max. rate	3 Mb/s	1 Mb/s	10 Mb/s	1 Mb/s
trans. dielectric	coax	twisted pair	coax	twisted pair
max. distance	1200 m	1200 m	2500 m	1200 m
max. number nodes	254	64	1,000	255
network connection	network controller card	interface controller, special hard disk server	network cont., special servo	network controller card
file protection	3 level	2 level	2 level	3 level

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1ST DOMESTICALLY DESIGNED PC LOCAL AREA NETWORK ANNOUNCED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 pp 13-14

[Article by the Office of Scientific Research, Tianjin University: "Distributed Local Network--T-Net Microcomputer Local Area Network"]

[Text] The distributed local network--T-net microcomputer local area network system developed by the Tianjin University Department of Computing passed its municipal level evaluation on 5 July 1986. The T-net microcomputer LAN was completely designed in accordance with the International Standards Organization (ISO) recommended Open System Interconnection (OSI) seven-layer reference model, and the networking system has been completely nationalized and has attained a working level. The T-net network is suitable for the automation of larger offices of enterprise and service units. The principle is to link several computers in different locations into a networked system with the goals of resource sharing, improvement of the reliability of computer facilities, distributed processing, and low cost, high quality service. This network uses the principle of layered structure to realize the network protocol. The technical keys are in the implementation of the network interface cards and transceiver, as well as the network communications software and the distributed database system.

In a comparison of the T-net microcomputer LAN with LAN's already imported and domestic LAN's currently under development, the following features can be noted:

1. The T-net structure is in complete accordance with the OSI standard recommended by the ISO, and has been designed according to the seven-layer model.

2. There is direct point-to-point communications, which avoids using intermediate servers.

3. At the application layer of the network system was developed a distributed database management system.

4. Both the network and the database are completely in Chinese, and moreover Chinese-character hard cards and software are Chinese character compatible, and both these Chinese-character methods may be used at the same time on a single network.

5. Network interface processors and the physical layer circuits use domestically produced devices, and all have been engineered.

6. The structure is modular, which aids in system expansion and improvement.

Technical Specifications for the Network

Network host: IBM PC/XT and compatibles

Transmission dielectric: 75 ohm baseband coax (SBYF-V-75-5)

Nodes: 100

Rate of transmission: 80 kb/s (8 MHz system clock)

Structure: bus competing network

Access method: equalized CSMA/CD protocol

Longest distance: 1.2 km

Chinese-character system: Chinese-character card and software Chinese characters may be used simultaneously on the system.

Price: each network interface card costs 600 yuan

Software:

1. File transmission system.

Features: point-to-point direct communications; logical records look-up at first level; electronic mail, screen display of remote printer functions.

2. High level commands.

3. Two distributed database management systems:

distributed database management system;
distributed ambiguous relational database.

The evaluation committee felt that the T-net network has all the features of general LANs, that its operation is reliable, that it is low cost, and that it has met the design requirements regarding all technical indexes for speed and longest distance for communication. T-net is the first local area network of practical usage in this country to be completely designed by us, and its overall economic and technical levels are foremost among local area networks in this country.

12586
CSO: 4008/1078

MICROCOMPUTER LAN SYSTEM DEVELOPED FOR ENTERPRISE MANAGEMENT

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 p 14

[Article by the Office of Scientific Research, Tianjin University: "Multi-Layer Microcomputer Local Area Network System for the Automation of Enterprise Management"]

[Text] The multi-layer microcomputer local area network system for enterprise management automation developed jointly by the Tianjin University Department of Computing and the Tianjin Electric Machinery Plant passed its municipal evaluation in June 1986.

The Tianjin Electric Machinery Plant is one of the Tianjin Municipal major enterprise transformation units as this plant has a certain technical and materials capacity, and there is a pressing demand throughout the plant to use advanced microcomputer networks to do enterprise management. Development personnel from project groups in the Tianjin University Department of Computing, with the assistance of the Tianjin Electric Machinery Plant, on several occasions studied the production workshops, the warehouses, and the management departments of the Electric Machinery Plant, and based on the requirements of the plant and the funding situation of the time, proposed an overall plan and concept. After numerous discussions by relevant specialists and application units, it was finally determined to use a dual layer network structure. The primary network would use OMNINET, to be installed and debugged jointly by the Tianjin University Department of Computing and the Tianjin Electric Machinery Plant. The sub-network A-SNET and the dual level applications software would all be designed in-house, and for workstations they chose the inexpensive Apple II. The microcomputer LAN system developed by development personnel from the project groups after 2 years of arduous effort has gone into operation at the Tianjin Electric Machinery Plant, and each goal has attained its design requirements. The features of the system are:

1. It uses a dual layer network structure, is suitable to the organizational structure of enterprises, and the load is evenly distributed.

2. The scale of the system is large, and sub-network hardware and software, and the entire applications software system has been entirely designed in-house.

3. The production planning and management software system uses scientific management methods for designing, which allows formulation of annual comprehensive planning--contract goods ordering--formulation of quarterly planning--formulation of monthly planning--formulation of materials planning, which together constitute series management, and which has brought real guidance to production.

4. The level of design for the general software is high, it is quite general, easy to operate, easy to learn, and all has been done through Chinese-character processing.

5. The structure of the A-SNET (sub-network) that was designed in-house is compact, rational, low in construction cost, of excellent performance, and innovative in design. A-SNET is the second layer in the Electric Machinery Plant network, and it implements information exchange and resources sharing between the first and second level network work stations. First level stations on the network can parallel process both local operations and network server functions. Anti-interference capabilities for the network are strong, and it can work stably in adverse conditions.

6. The entire network has great capacity for operations. The network system design is advanced, with powerful functions, low cost, and reliable operations.

The evaluation found that: the overall design philosophy of this system is advanced and rational. The design of the A-SNET (sub-network) and the design of the general software is innovative. It uses the OMNINET network with Apple II's as workstations and the in-house designed A-SNET (sub-network) to realize full scale management of medium-size enterprises, and this is the first time in this country that small machines have been used to manage medium-size enterprises.

12586
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NEW MICRO-BASED FLOWMETER DESIGN ANNOUNCED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 pp 14-15

[Article by Yu Zhongrong [0151 0112 1369]: "XLF-10 Microcomputer Mass Flowmeter"]

[Text] The microcomputer mass flowmeter developed jointly by the Tianjin Automatic Meter Plant No 10 and Zhejiang University passed its technical evaluation in June 1986. This intelligent meter is fitted with appropriate transducers, and can be used for measuring the flow of saturated steam, superheated steam, and various gases. It is capable of automatic pressure, temperature, or density compensation, has eight analog quantity input terminals, and can simultaneously detect multichannel parameters or composite multichannel measurements and compensation systems.

I. Structure and Principles

This instrument use the Z-80 CPU as its central processor unit, and is fitted with conversion, input/output interface, and storage circuits. The host machine and the display and printing portions are each independent, for convenient selection by the user. The display portion uses eight segment LED's to display the measured parameters and time, and it also has an automatic printout function. The constituent circuits are the A/D conversion unit, the arithmetic unit, the display unit, the printing unit, and the control unit.

The basic equation for flow calculations is:

$$M = 0.0125\alpha\beta^2\varepsilon D^2 \sqrt{\Delta P \cdot \rho}$$

In actual practice, the flow coefficient α, the flow beam expansion coefficient ε, the aperture diameter ratio β, the control diameter D, and the density ρ, all change with the field working conditions, the temperature, the pressure P, and the Reynolds number Re. Through software design, this instrument does progressive correction calculations regarding the factors just described, consequently allowing maintenance of a high degree of precision throughout the measurement.

II. Instrument Features

1. The instrument is highly hardware integrated, and stability and reliability are correspondingly powerful, allowing ease of maintenance.

2. It uses microelectronics technology, has memory functions, can realize automatically compensated accumulated calculations, and the calculations use a floating point decimal for high precision.

3. Instrument software is flexible, it has a broad scope of application, it is convenient to alter, and there can be as many as eight inputs.

4. The functions are powerful, the instrument has six task selection functions, and that portion that need not be printed out can simply be displayed.

5. The instrument is cleanly constructed, small, lightweight, and easy to use.

III. Primary Technical Specifications

A. Basic margin of error: 0.5 percent

B. Input signals (8-channel analog): 0~10 mA, 4~20 mA, 1~5 V.

C. Display output: eight digit LED digital tubes.

1. There are warnings on all circuits for excesses in pressure, temperature, density, momentary flows, accumulated calculated flows, as well as having time, day, hour, and minutes displayed alternately.

2. There is a fixed display of momentary flows or of accumulated calculations of flows.

D. Print out output: uses 45mm wide paper in a dot matrix printer, which can print at fixed intervals or randomly the pressure, temperature (density), momentary flows, accumulated calculated flows, time, month, day, hour, and minute for each circuit.

E. Working mode: continuous.

F. Power source: 220 V $\pm$ 10% 50Hz $\pm$ 5%.

G. Power: < 8 VA.

H. Ambient temperature: 0~45 C.

I. External dimensions: 160 X 80 X 320mm.

Experts in the technical evaluation committee felt that the XLF-10 mass flowmeter can do real time calculations of the parameters affected by the temperatures, pressures, and Reynolds numbers in the basic formulae for flow calculations in the international standard ISO-5167 and the national standard GB-2624, consequently allowing the measurements to maintain a high degree of precision throughout. This is a new thing in linear calculation compensation method design philosophies, and is of an advanced level in this country.

HEAVY-DUTY MICROCOMPUTER BUILT FOR MILITARY USE

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese
No 11, 15 Nov 86 pp 15-16

[Article by Li Guibin [2621 2710 2430], Tianjin Municipal Economics Commission, Office of Military Projects: "The 7JW86/001 Hardened Microcomputer System"]

[Text] The large quantities of Intel Corporation OEM products and microcomputer systems currently being purchased from abroad are all general use products that cannot satisfy the demands of high reliability in adverse conditions. Either foreign advanced military microcomputers cannot be imported, or else their cost is too great, so there has been an urgent need in domestic applications for the development of a hardened microcomputer system.

With the support of relevant units of the Institute No 707 of the China State Shipbuilding Corporation, and after more than 2 years time, the 7JW86/001 ruggedized microcomputer system was developed, and this passed its technical evaluation in March 1986 in Tianjin. This project has a foremost position in this country, as it fills a void regarding 16-bit microprocessor hardened systems.

This system was designed and developed in emulation of the American EMM Company's SECS80, and it is generalized, standardized, and serialized, having attained the goals specified in the PRC and military standards GJBV4.1~4.13-83.

Primary Performance and Technical Specifications

1. CPU: iAPX86/10 (8086) or iAPX86/20 (8086 + 8087) 16-bit microprocessor, with a 5MHz $\pm$0.1% clock.

2. Eight data types: 8, 16, 32, 64-bit integers. 32, 64, 80-bit floating point numbers, and 18-bit BCD.

3. IMB storage time

4. Interrupts: DJJ86/10 or 86/20 9 levels from 19 sources for interrupts, which may be expanded to the 256 level DJJ544 with 12 levels from 18 sources

5. I/O channels: directly addresses 256, with 64K of indexed addresses

6. System software:

   7JW86/01 MONITOR, completely compatible with the ISBC957B.

   7JW86/01-SCT (system confidence test program) DJJ544 MONITOR (544 board 8085 monitor program), compatible with the ISBC930.

   The system can be configured with the iRMX-86 operating system.

7. Module physical dimensions:

   length X width X depth is 1228.6 X 152.4 X 16.5 mm

8. Case physical dimensions:

   ATR-11 11 slots 257.05 X 193.04 X 398.8 mm

   ATR-7 7 slots 257.05 X 193.04 X 332.7 mm

9. Power source modular capacity:

   +15V15A, +12V0.5A, -12V0.5A

10. Environmental conditions:

    Complies with relevant conditions of the national standard GJBV4.1~V4.13-83 for military use

11. Average no-fault operating time: MTBF $\geq$ 8,000 hours

    Average maintenance time < 30 minutes

This system uses highly reliable components, a secondary heat radiating hermetically-sealed case, and it may be widely used in vehicles, vessels, aircraft, tanks, and in mines.

12586
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COMPUTER-CONTROLLED TETRACYCLINE FERMENTATION PROCESS

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 11, 15 Nov 86 p 16

[Article by Peng Haiyun [1756 3189 6663], Tianjin Municipal Institute of Industrial Automation Instrumentation: "Tetracycline Fermentation Process Microcomputer Automated Control System"]

[Text] The fermentation process, and especially that for the pharmaceutical industry, is basically a manual operation. How are we to allow microorganisms to ferment in better environments and under better conditions when at present we have imperfect means for on-line detection and control, which has caused much inconvenience for production and has led to losses and waste. For these reasons, as production has grown it has become imperative to use microcomputer control for the fermentation production process. The tetracycline fermentation production process designed by the Tianjin Municipal Institute of Industrial Automation Instrumentation for the Tianjin Pharmaceutical Plant incorporates microcomputer control systems and passed its technical evaluation in July 1986.

This system has three modes of operation.

1. field manual operation mode;

2. control room remote operations mode;

3. microcomputer automatic control mode.

At the same time, it also has manual and automatic cascading bidirectional non-disturbing switching functions.

This system has six control loops:

1. pot warmth control loop;

2. ventilation control loop;

3. mixer rotation control loop;

4. pH value control loop;

5. pot pressure control loop;

6. quantitative sugar supplement loop.

This system has 17 detection quantities, 5 calculated amounts, 3 accumulated measured amounts, 6 warning points, 8 recording points, and 1 interlock, and alarms.

Test production operations with eight pots over 2 1/2 months have shown that:

1. The Tetracycline Fermentation Process Microcomputer Automated Control System was stable and reliable during test production operations, was accurate in detection data, had a high degree of control precision, and met the technical requirements, all of which meets the original design goals.

2. Since the test production operations of this system, there have been better economic results from production. According to estimates based on the two regular pots that were a fermentation unit during test production operations, in 1 year each pot could increase its results by 319,000 yuan. In addition, for production technology personnel this system provides important means with which to clarify the mutual relations between various technical parameters, to explore more deeply the tetracycline fermentation mechanisms, to implement optimal control, and to attain stable production and high yield. This promises even greater potential results.

3. Using microcomputers for process control in antibiotic fermentation processes has a certain degree of advancement at present in China, the performance to price ratio is high, and there is a certain guiding significance to this which has dissemination value. It is recommended that applications and dissemination be done as quickly as possible.

In addition, when production conditions were not favorable, or even when there were short-term malfunctions or operational errors, this microcomputer control system was able to promptly provide various data to technicians so that they might use effective measures, which reduced losses and shows even more clearly the superiority of the microcomputer control system.

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MICROCOMPUTER CONTROL SYSTEM FOR BEER FERMENTATION REPORTED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese
No 11, 15 Nov 86 pp 17-18

[Article by the Tianjin Municipal Automation Instrumentation Company Office of Scientific Research: "Microcomputer Control System for the Cone Vessel Beer Fermentation Process"]

[Text] In the beer production process, fermenting techniques are important technologies. It is a complex biochemical reaction process. The major change is when sugar generates carbon dioxide and ethyl alcohol (alcohol). Control of the time and temperatures of fermentation are one of the important factors directly related to the quality of the beer fermentation. The fermentation temperature and age of the alcohol are intimately related to beer quality. In the fermentation process that takes more than 10 days, by mastering and controlling the ideal laws of fermentation temperature in accordance with the strength of the yeast activity and the speed of growth and reproduction, the age of the alcohol can be reduced, resulting in a high quality beer. Therefore, in the beer fermentation process control of the fermenting liquid temperature is a very important factor. The experience of actual practice has shown that if the temperatures at each stage are controlled to be within plus or minus 0.05 degrees Centigrade, then the reproduction and decay of the yeast, the consumption of sugar in the malt, and impurities such as diacetyl can all be at more ideal states.

In the past, beer production in China has used traditional techniques, and the operations have been manually controlled. At present, the majority use the new open-air cone-shaped vessel fermentation technique. The feature of this technique lies in its ability to shorten the fermentation time, as well as being suitable for the production of various kinds of beer. Fermentation occurs in a cone-shaped vessel of 100 cubic meters capacity, and the heat generated by the fermentation is removed by a cooling liquid flowing through a jacket. By controlling the flow of the cooling liquid, the goal is attained of controlling the temperature.

Temperature changes are slow during the entire time of the beer fermentation. However, through a process of temperature maintenance, rises in temperature at a certain rate, even temperatures, and lowered temperatures, the changes in the required temperatures should be within 0.5 degrees Centigrade.

The open-air cone-shaped fermentation vessel configuration is in the open air, some 10 meters high, has a diameter of several meters usually, and is airtight. Therefore, its temperatures cannot be measured with a mercury thermometer. Since the pressure and temperatures must be controlled, using manual methods as in the past is just not possible. Therefore, instruments must be used for remote measurement and control. The cone-shaped fermentation vessel as an object of control has a long delay and great inertia, and to control fermentation liquid temperatures within 0.5 degrees Centigrade is not possible with ordinary regulation systems.

For this reason, The Tianjin Municipal Institute of Automation Instruments Unit Design developed an open air cone-shaped vessel beer fermentation process microcomputer control system, suitable for use in rotating detection and control of temperature, pressure, and liquid levels for the beer fermentation process. The system also allows color CRT display and print outs. It can meet the needs of programmed control of beer fermentation, and keeps the controlled temperature deviation within 0.5 degrees Centigrade of the specified range.

This Microcomputer Control System Has the Following Features:

1. It has rather complete functions and can do programmed control of 20 temperature points with a high degree of control precision. There can be preset control of 10 pressure points, with automatic detection and graphics display of several liquid level values. The operating parameters of any vessel may be referenced, pictures displayed, and data and reports can be printed out at any time or at fixed times.

2. It ensures the reliability of the operation of the production techniques, and it also has temperature display alarms from conventional instruments and a reserve manual operations system.

3. This system can satisfy the demands of production in accordance with the needs of the production and work process through interactive and arbitrary on-line revision of technical parameters and control process settings, which ensures product quality.

4. The performance to price ratio is quite high. To accomplish similar automatic control demands, use of this system can reduce investment by one-third or one-half over that when using conventional instrumentation.

5. The structure of this system is simple, and operations are convenient and easy to learn.

Composition of the System

1. The Microcomputer System

This system uses an industrial controller fitted with the 6502 CPU microprocessor as the host processor, uses 5 1/4 inch disk drives as external storage equipment, and is also fitted with a color CRT for high resolution

graphics display in six colors; a nine-pin wide carriage 132 column printer for reports. The various controller cards that come with it include: four A/D/A cards; one printer card; one driver card; one real-time clock card, and a special cooling fan.

The microcomputer automatic control system uses the A/D/A cards for analog/digital and digital/analog conversion. They send the physical values for the temperature, pressure, and liquid levels to the microcomputer system, which displays and controls them. As far as software processing is concerned, it uses digital filtering, alteration of the program values, and linear rectification, and analog quantity/switch quantity conversions and output.

This system was written in expanded BASIC, is directly interactive, all operating parameters can be input or altered at any time to keep in line with the beer production technical curve. In addition, the superior functions of the software can be used in different modes for calculations on various parameters, and to display and print out reports.

2. The Instrumentation System

Platinum resistors are used for temperature measurement, and the temperature changes are converted to 0~10 mA analog values. The pressure converter converts the pressure changes into 0~10 mA analog quantities. The pressure differential converter changes the liquid levels into 0~10 mA analog quantities. They all send their 0~10 mA analog quantities to the microcomputer and to secondary instrumentation. There is a mid-range temperature display on the controlling instrument panel, and this uses a single needle reading instrument with upper and lower limit warnings to indicate the mid-range temperatures in the beer liquid. It is fitted with a flashing signal alarm, which acts as a temperature alarm. Instrumentation control is through two-position hand operators for pressure and temperature control, and there are also manual/automatic switchover switches, and both states have ammeters to show the current control state.

The output system uses transistor circuits to connect the microcomputer and instruments, and switches to control the electromagnetic valves.

This system passed its technical evaluation in July 1986, and the evaluation stated that the performance to price ratio of this system was higher than single-board computer systems already existing domestically. The system was held to reach advanced levels of control for the domestic beer fermentation process, and that it was of value for dissemination and application in similar industries in China.

12586
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COMPUTER CONSTRUCTION BUDGET PROGRAM ANNOUNCED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese
No 11, 15 Nov 86 p 18

[Text] With the continued growth of the building industry and the continued restructuring of modes of operation, traditional manual methods of preparing construction budgets are not only low in efficiency, slow and prone to error, but they are also difficult to accomplish before the project begins, and cannot meet the goals of controlling construction and materials. In order to reduce the preparation process for building project construction budgets, to allow data to become more timely and accurate, and to do a good job with construction preparations, the Tianjin Second Building Construction Company joined with the Computing Center of the China Academy of Building Sciences to create the "Construction Budget" (SGYS) program. After test budgeting, the construction budgets created by this program calculated rapidly, were quite accurate, had simple ways to fill in forms, and the labor costs, materials costs, and machinery costs that it output were comparable with those of designed budgets. This system uses computers in a completely systematic way to provide conditions and experience for construction management.

Composition of the Program

This program is composed of four modules:

1. Program module to enter tables--$SGYS_0$.

The functions of this module are to set up files for calculation tables for the project quantities, comprehensive tables, and building area tables.

2. Program module to set up a quota library and other library files--$SGYS_1$.

The functions of this module are to set up various database files, and to add to, delete, and revise them.

3. Program module for engineering quantities calculations, sets of quotas, and to calculate labor and materials used--$SGYS_2$.

The functions of this module are to do engineering quantitative calculations, to link quotas, to calculate quota work days and the amounts of various materials, as well as labor costs, materials costs, and machinery costs, and to set up intermediate output files.

4. Program module for results output--$SGYS_3$.

The functions of this module are to process intermediary output files, to print out 14 different report forms, such as labor and materials to be used and analyses of labor and materials (by item), all by units, levels, and for the entire project, as well as the first direct expense itemized accounts for a partial project budget, the second direct expense itemized accounts, together with a project budget itemized accounts for expenses.

Of the four modules just described, only $SGYS_0$, $SGYS_2$, and $SGYS_3$ are needed when doing a construction budget. $SGYS_1$ is for use when setting up library files, and also afterward when there is a need to revise the library.

Program Characteristics

1. This program may be used directly on the IBM PC/XT's and the GW-0520A computers, and it works on the CCDOS Chinese character operating system, with Chinese character output and Chinese character print outs.

2. This program was written in COBOL, uses structured program design techniques, the source code structure is clear, easy to read, easy to understand, and may be easily transferred to other computers.

3. To reduce the time spent in setting up the quota libraries and repeatedly keying in types of work and materials terms, a file has been created of types of work and materials terms, and there are libraries of concrete and mortar proportions, door and window hardware, and plaster proportions, which reduces the amount of labor needed for setting up these libraries.

12586
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ON-SCREEN Z80 ASSEMBLER/DISASSEMBLER ANNOUNCED

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese
No 11, 15 Nov 86 pp 18, 31

[Article by Qin Hongyi [4440 7703 0308], Office of Information, Tianjin Computer Plant: "On-Screen Assembler/Disassembler System"]

[Text] The on-screen assembler, disassembler developed by the Tianjin Computer Plant has passed its finalized design evaluation. This program is powerful, easy to use and economical, reliable, and is a capable tool for application software development. It is convenient for many users, and improves usage efficiency of microcomputers.

Single-board computers are commonly used as instructional computers and in industrial process control, but one great deficiency is that it is not possible to directly enter assembly language. For high level languages, too, the machine code for each instruction must be found in a table before the program can be entered in the computer. The entire process is not only troublesome, but it also easily leads to entering erroneous instructions. To this end, the Tianjin Computing Plant has developed a screen assembler, disassembler software system on the Z80-II single-board computer, so programmers may monitor the input through a standard keyboard of Z80 instructions on a CRT.

In its use at State-Run Plant No 4508, this system software has yet to fail, and there is accurate assembly and disassembly of each instruction in the Z80 language. At the same time, one may respond with Z80 pseudo-code, which allows for the saving of a lot of time when writing user programs, and it eliminates the errors that come from looking up in tables. Practice has shown that the development of this software has been successful, that it is easy to learn, convenient to use, flexible, and can greatly improve the speed and efficiency of programming. It is clearer for the machine-based practice of beginners and for learning Z80 assembly language, and is easy to learn from.

12586
CSO: 4008/1078

BEIJING FACTORY IMPLEMENTS ANTI-POLLUTION MEASURES

OW270648 Beijing XINHUA in English 0534 GMT 27 Apr 87

["News Feature: Beijing Iron, Steel Works Cleans Up"--XINHUA headline]

[Text] Beijing, 27 Apr (XINHUA)--For most people, opening windows to let in the fresh morning air is a common practice, but Li Xintian's family was deprived of this luxury.

For the past several years, Li had to close his windows day and night to keep out coal dust from a nearby iron and steel factory. The sintering factory belongs to Beijing's Capital Iron and Steel Company, one of China's ten largest.

"It used to be impossible for us to dry clothes or eat meals in the courtyard of our home," Li said, "but since the factory implemented an ambitious air pollution control project, we can open our windows whenever we like."

Yang Chongshen, an engineer in charge of the company's pollution control office, said, "to fight pollution, the company has allocated 279 million yuan (75 million U.S. dollars) since 1979 for different projects."

The investment, which used 20 percent of the company's total allocations earmarked for technological upgrading, has funded 297 environmental protection projects.

The sintering factory, located in Li's neighborhood in western Beijing, was the company's major source of pollution. Now, the factory is equipped with a closed cooling system, which has reduced dust pollutants by 10,000 tons annually, and the plant is believed to be China's cleanest, Yang said.

"Workers at the factory even wear lab coats while operating the control room," Quo Jimin, a company repairman said, adding another workshop has also installed an air-filtering system, and cut dust expulsion by 6,500 tons annually.

"In addition to implementing the air pollution control program," Yang said, "the factory is now able to treat almost all of its industrial wastewater."

"Since the plant's industrial boilers were converted to the use of gas, the company saves 180,000 tons of coal a year and has cut daily sulfur dioxide fumes by 32 tons and coal dust by 48 tons," Yang continued.

"To make the air around the factory even cleaner," Yang said, "the capital iron and steel company, which covers 3.8 square kilometers and employs 120,000, has treated one million tons of industrial waste, planted 1.75 million trees and seeded 495,000 square meters of grass and flowers."

"The factory's green areas are expected to expand to 21 percent compared with only 7 percent eight years ago," she added.

/8309
CSO: 4010/1022

BRIEFS

HENAN'S KAIFENG IMPROVES ECOLOGICAL ENVIRONMENT--Zhengzhou, 11 May (XINHUA)--By improving the ecological environment, Kaifeng's 1986 total agricultural income increased 13 percent, and per capita income increased 8.6 percent over 1985. Despite last year's serious drought, Kaifeng sold 165,000 tons of grain to the state, and over 80 percent of the city's local farmers were self-sufficient in grain. In the past, Kaifeng, Lankao, Weishi, Tongxu and Qixian have suffered at the hand of natural disasters such as wind, soil salinization, flood and drought, which resulted in a poor ecological environment. Recently, Kaifeng has been active in afforestation, and now green areas cover 17.8 percent of the total, and trees surround 380,000 hectares of farmland. Agriculture and forestry development are providing abundant fodder for the city's animal husbandry industry, which earned 140 million yuan (37.8 million U.S. dollars) last year, 45 percent more than 1985. [Text] [Beijing XINHUA in English 1429 GMT 11 May 87] /8309

ANTIPOLLUTION TASKS--Beijing, 23 May (XINHUA)--The Chinese capital, Beijing, is plagued by serious air pollution, but not as much as in the capital cities of some foreign countries, Qu Geping, director of the State Environmental Protection Bureau, said here today. Beijing's average dust content per cubic meter is 500 milligrams, higher than in many other capital cities, Qu told a press conference. The country's standard maximum is 150 milligrams of dust per cubic meter. However, he added, the contents of sulfur dioxide, nitrogen oxide, carbon nitride and ozone in the air of Beijing are all below the required norms. "Beijing has no photochemical contamination, which plagues many other major cities overseas," he said. "The environmental conditions have not been worsened along with the country's economic progress," the director said. "But the Chinese people still face an arduous task of combating air, noise and water pollution, and treating sewage," he said. The official said that acid rain contamination is not so serious in China except in the areas along the Yangtze River in Sichuan and Guizhou provinces, which is caused by an excessive use of coal. Efforts will be made to control the sulphur content in coal to reduce the threat of acid rain, according to the official. [Text] [Beijing XINHUA in English 1436 GMT 23 May 87] /8309

CSO: 4010/1022

MEDIA NAME 10 MAJOR S&T ACHIEVEMENTS FOR 1986

Beijing KEJI RIBAO in Chinese 1 Jan 87 p 1

[Text] The Central Television Station and This Paper Join in Choosing 10 Major S&T Achievements for 1986

1. Computer-aided management system for aircraft design and manufacture.

2. "China's Layer-Controlled Ore Deposit Geochemistry"

3. Long-Wave Time Service System

4. Type-B Hepatitis Blood Source Vaccine

5. Large Scale Urea Facility with Annual Production of 520,000 Tons

6. Developmental Research into Coal Gas

7. Research into Experimental Technology for Free Brain Functions

8. Four Boric-Acid Aluminum Yttrium Neodymium Crystals

9. The World's First New Hybridized Brassica napus Product is Successfully Developed--Qin Oil No 2

10. 115,000 Ton Shuttle Oil Tanker

In 1986, significant achievements were made in science and technology efforts in this country. Through the recommendations of pertinent sectors, the Central Television Station and this newspaper joined to select 10 major science and technology achievements.

1. This project was arranged and implemented by the Ministry of Aeronautics, where a mainframe integrated software system was developed on a Siemens 7760 computer that has 11 branch systems, 40 subsystems, and 450,000 lines of program code, and which is the first in this country to successfully use a database as the kernel of a system. The scale of this system is large, it has powerful functions, is highly integrated, and is easy to use. It implements computer assistance for the primary special fields in the process of aircraft

development, allowing this country to take an active step on the road to the modernization of aircraft manufacture. The entire system passed its evaluation in October 1986, and after being used for applications has already resulted in outstanding economic results.

2. This is the first major comprehensive work on layer controlled mineral deposits and other geochemical aspects, and it has been completed under the direction of Professor Tu Guangchi [3205 0342 3589] of the Institute of Geochemistry of the Chinese Academy of Sciences. It is the final result of study from 1979 through 1986 on various major mineral deposits in this country. This work brings closely together the geological realities in this country, expands the scope of varieties of level-controlled mineral deposits here, and reveals the multiple cycle characteristics of the geological development of this country; there have been several theoretical innovations, and in methodology many are the first applications in geological research; several new facts have been discovered, from which have been obtained large quantities of demonstrative data and information on contributing factors. This has had a stimulating effect for research on mineral deposit studies and geochemistry in this country, and has been an important contribution to mineral deposit studies throughout the world.

3. The long-wave time service system is a major national project under the general responsibility of the Chinese Academy of Sciences, which from its authorized establishment in 1973 until it passed its evaluation in June 1986 had formed a long-wave time service system that included atomic time frequency reference, a long wave broadcasting tower, and a reception monitoring system, as well as wave propagation time prediction. It improved the time service accuracy in this country from milliseconds (one-thousandths of a second) to microseconds (one ten-thousandths of a second), allowing this country to enter the advanced ranks of the world in the aspect of atomic time service systems. During the test broadcast stage, it has already played an important role in this country's development of strategic weapons testing, space technology, and other fields.

4. This vaccine developed by the Institute of Biology of the Ministry of Public Health subjects the plasma of symptomless carriers of type-B hepatitis surface antigens to extraction of effective antigens through a multiple enrichment and purification process, then adds a supplementary preparation after a multiple step deactivation. Careful physical observations have proved that the vaccine is safe and effective. After innoculation of adults, pre-school children, and new-borns, there were positive results for antibodies more than 95 percent of the time, in 80-90 percent of the cases mothers did not transmit it to infants, and in epidemic areas, 3 years after innoculation of infants, the rate of protection was 86 percent. Based on the results of mice immunity experiments and mother-infant cessation of transmission, the quality of the vaccine has attained the level of high quality similar products internationally, and the production and dissemination for use will generate large social and economic results.

5. This project was jointly organized and implemented by the chemical industrial and machinery systems, and the entire set of equipment has been designed and manufactured with a concentration on the domestic but with

international cooperation. Primary equipment includes 83 different things in 151 implementations, among which 62 models and 127 implementations were designed in China. The overall technology for the entire system is of a level equal to that internationally of the late 1970's and early 1980's. Since going into trial production at the Zhenhai Petrochemical Main Plant in September 1984, this set of equipment has been running for more than 10,000 hours, has produced more than 600,000 tons of urea, and after formal start of operations, its yearly output value could reach 184 million yuan. Its successful manufacture is an important milestone as we conclude reliance on imports for large scale chemical fertilizer production equipment and as we realize its nationalization.

6. This research achievement as accomplished by the Ministry of Petroleum Industries occupies a place in the domestic forefront in terms of the gas and oil geochemical features in the coal system, the conditions for formation of gas pools from coal, and the evaluation of resources, among which the overall index research for identifying coal gas was of an internationally advanced level. This achievement was used in the S.E. Qiong Basin of the South China Sea to discover the largest pools of coal gas fields to date in this country. Coal gas stores and gas-bearing structures were discovered in the Dong'ao basin in Henan, the Shaanxi-Gansu-Ningxia basin, the Huabei basin, and the Songliao basin, and there have been successful experiments in the Sichuan basin with various mining techniques and technologies, all of which have played major roles in natural gas exploration and extraction in this country.

7. This is an important key technology in urgent need of resolution in the free-brain studies of all countries in the world. This research achievement that was accomplished by the Institute of Space Medicine Engineering of the National Defense Science, Technology, and Industry Commission proceeded from such advanced theories as systems theories and functional states to derive a modern advanced electroencephalogical data processing technology. On a basis of experimentation, they proposed "nerve synergetics," and formed a set of new experiment technologies, among which brainwave fluctuation charts and 10 fluctuation analysis technologies rank within the forefront both in this country and abroad. This research has resulted in large quantities of new information regarding brain function activities, it has provided a diversified macroscopic space-time picture for understanding the brain, and has provided a basis for intellectual exploitation of the human brain and for improving memory efficiency.

8. The Institute of Crystal Materials at Shandong University used the theories of crystal chemistry and crystal physics to analyze lasers and the characteristics of non-linear basic materials, creatively developing successfully for the first time in the world this new type of highly efficient automatic frequency multiplying compound function crystal for lasers from 1.06 microns to 0.53 microns, which passed its evaluation in March 1986. This type of material has a use value in aspects such as laser holography, measurement, and collimation. Through study of a series of technical processes during the crystal maturation process, they basically took control of the laws of maturation, and can grow crystals that exceed 2 cm from which they can process centimeter grade crystals for use, attaining an advanced international level.

9. Qin Oil No 2 is another major breakthrough since successful cultivation of hybrid paddy rice varieties in the 1970's that has been obtained from using hybrid superiorities to undertake cultivation research among major crops. This variety that was successfully matched by people such as agronomist Li Dianrong [2621 3013 2837] of the Shaanxi Province Agricultural Science Education Center was obtained through the complementary technologies of male sterility, maintenance systems, and recovery systems with the Brassica napus cytoplasm, the primary characteristics of which are a large number of seeds in a pod, leaf clumps that are healthy and vigorous, and highly resistant to diseases. Experiments in more than 600,000 mu of different kinds of farm land showed that yield per mu is about 30 percent greater than for regular rapeseed products.

10. The 115,000-ton oil tanker that was launched from the Dalian Shipyard in September 1986 was the largest and most advanced ship ever made in this country. It is of an advanced international level of the 1980's, and throughout the world there are only a few nations capable of building such a ship. The steamer is 256 m in length, 46 m broad, 22.2 m high, has a load capacity of 115,000 tons, and can contain 136,500 cubic meters of oil. It uses advanced technologies such as automatic positioning systems, remote control of the main engine, and shaft-borne generators, so that there is a high degree of automation.

12586
CSO: 4008/2051

BEIJING RESEARCH INSTITUTE COMPUTER APPLICATIONS

Beijing BEIJING KEJIBAO in Chinese No 813, 8 Sep 86 p 1

[Article by Bie Qinghe [0446 3237 3109]: "By Constant Strengthening of Its Computer Strength, City Science Research Institute Has Achieved the Capacity to Take on Major Topics"]

[Text] Computer effective strength that is more powerful for supporting development, that has more abundant technical capacity, and where computer equipment is more complete is currently coming into being at the Beijing Science and Technology Research Institute. This institute has recently indicated that in coming years a group of outstanding computer applications and achievements will be available to society; at the same time, it has also taken on some topics for society in urgent need of resolution.

Beginning in 1983 this municipal science institute has gradually completed laying the foundation and gathering strength in areas of computer applications, and has entered the stage of developing applications. As of this moment, this institute has a solid technical contingent for computer software and hardware. There are at present 437 computer technicians, 11 high level technicians, 80 mid-level personnel, and 118 entry level personnel. In addition, they have two mainframe computers, 3 minicomputers, 65 microcomputers of various types, as well as some advanced sets of equipment. Consequently, they have formed a rising new computer force in the Beijing region that can handle tasking such as high technology development for computers, large scale information management and databases, process control, various intelligent instrument development, and data recording of large quantities of data in both Western languages and Chinese.

Relying upon this abundant technical power in computer aspects, this institute has already accomplished some projects with great economic and social results in the areas of computer technology development, computer information management systems, database information technologies, and process control. Some 27 among these have won national and ministry or municipal awards.

To help enterprises turn losses into profits, to change the common failing of the past where information flows greatly lagged behind the flow of goods and materials, technical personnel from the national software development departments of this institute cooperated with teachers and students from the

Department of Computing at Beijing University to fully accomplish the shift by the Nanjing Railway Manufacturing Factory to the comprehensive information management system of a component plant. Specialists uniformly recognize that the viewpoint, numerical methods, and computers of this system are means that provide various kinds of management for production operations such as aids for decision making, planning formulations, production organization, and statistical analysis. This provides powerful tools for the modern management of an enterprise, which have been unanimously praised in factory and enterprise circles. Now, the New Office of Technology has both united the strengths of Beijing University and taken on a computer applications project that is a large scale enterprise management system for the Beijing Television Plant, striving to remold a model for enterprise circles in Beijing.

Aside from this, this institute has also done a great deal of work in the areas of intelligent and computerized instrumentation. As for example where the Solar Energy Institute has used a single-chip computer to control a high-rise message system, which has good performance, was inexpensive to build, is easy to use, and this achievement has been included in manuals for building design, and is as well about to be used in construction of youth apartments. The Office of New Technology has used a single board computer to accomplish data processing for a capillary constant speed electrophoresis multi-function instrument, which instruments have attained current international levels or nearly so.

12586
CSO: 4008/1024

BEIJING S&T COOP CENTER UNITES OVER 100 S&T UNITS

Beijing RENMIN RIBAO in Chinese 2 Dec 86 p 3

[Article by Yi Xiao [5337 4562]]

[Text] "The most flexible and effective work style is uniting the official units, and cooperative organization of civilian units" is how some people are describing the Beijing S&T Coop Center. This center responds to the need to reform the S&T situation by combining the strengths of the capital in S&T in order to create greater technical and economic benefits each year.

In recent years the number of cooperative items undertaken by the center has risen sharply, from 372 in 1983 to 638 in 1984 to 1554 in 1985. Between January and November 1986 1450 items had been undertaken; the total for the entire year is expected to reach 1600. The 1985 cooperative items increased the net income of enterprises by 135 million yuan; and the income of S&T units by 30.8 million yuan. Benefits during 1986 are expected to be even greater. The number of units participating in the work of the Coop Center increased from 102 3 years ago to 131. The sections of the Coop Center increased from 22 to 49 and the number of joint scientific research and production groups increased from 10-odd to 63.

The Coop Center is the cooperative S&T organization of the mass organization of Beijing S&T workers, Beijing's S&T units, the universities and colleges, and the Beijing municipal government. The Municipal Economic Committee issues twice a year, through the Coop Center, a report on "The State of Industrial Development in Beijing and the Development of Key Industries" which supplies timely and accurate information. During the last 2 years, the Coop Center has, by means such as providing guidance on difficult problems, introducing results, technical conferences, and bringing counterparts together, without compensation introduced more than 5000 S&T results to enterprises and provided S&T units with more than 3000 items for technical development. Enterprises have solved many problems of technical restructuring and product development through the work of the Coop Center. At the beginning of 1986, the Wuxing Beer Factory was negotiating on the import of open brewing equipment and technology. The exporter wanted $620,000 for the microorganism control system used in the brewing process. After the Beijing Institute of Technology took on this project a system was constructed for only 300,000 yuan which was just as good as the syste This Chinese-made system is easy to manage and control and

was equal in all respects to the system which Wuxing Beer was planning to import. The Coop Center organized a conference of more than 100 committee-level units to discuss 18 key problems in the construction of the municipality and in the conservation of energy and water. In April, 1986 Qinghua University and the Beijing Chemical Fiber Institute carried out a resources conservation audit of the Beijing Dye Factory. Eleven audit reports on topics such as conserving water, coal gas, steam and soda. The audit report on soda conservation alone resultediin an annual savings of 1 million yuan. According to data from Beijing Dye, implementation of some of the reccommendations during 1986 resulted in a decline in resources consumption of 17.7 percent.

Recognizing that the S&T strengths of the capital are the wealth of the entire nation, tne Coop Center and the Beijing Municipal Office for Economic and Technical Cooperation are jointly mobilizing the S&T strengths of the capital to serve cities and provinces throughout China. During the last 2 years, agreements on a total of more than 1900 items have been signed and more than 10 Beijing delegations have visted other areas.

12369
CSO: 4008/2035

BEIJING EXCHANGE CENTER TRAINS SKILLED WORKERS

OW070318 Beijing XINHUA in English 0104 GMT 7 May 87

[Text] Beijing, 7 May (XINHUA)--The Beijing Science and Technology Exchange Center runs various courses to train more skilled workers for the Chinese capital.

Wang Yongjing, head of the center, said it has already trained 58,000 workers in about 40 fields, including food processing and computer operation.

The existing system takes workers straight from school. They have very little training but acquire most of their skills from assisting older colleagues.

"Our center tries to provide Beijing workers with the opportunity to apply theory to practice and vice versa," said Wang.

Over the past four years, Wang said, the center has compiled some 100 types of training manuals, of which some have been chosen as textbooks for colleges.

Apart from classroom teaching, Wang said, the center also hosts technical performances, contests and seminars to enable the students to apply what they learn in class.

"Without the center, I could have achieved nothing," said Wu Zhuoli, a 50-year-old worker from the Beijing sewing machine factory who has had only an elementary school education.

Wu began to attend classes at the center in the 1960s. With the help of spare-time teachers, he studied courses like mechanical theory, drawing and design.

A pipe dredger Wu designed in 1984 is hailed as the most advanced by same domestic users, and negotiations are in full swing for joint production of the machine with a U.S. and a Federal German company.

To meet the pressing demand for technical innovation in the city, the center divides the workers into different specialized groups headed by veteran professors and engineers to undertake study projects proffered by enterprises. Last year alone, their efforts saved the factories concerned about 96 million yuan (about 26 million U.S. dollars).

To help realize the targets in the current "sparking plan," part of China's efforts to spread technology in the countryside, last year the center began to train technicians and managers from rural factories outside the Beijing [words indistinct].

The Beijing center was founded by Ni Zhifu, chairman of the All-China Federation of Trade Unions, and Li Ruihuan, mayor of Tianjin. There are similar institutions in other parts of China.

/8309
CSO: 4010/1023

WUHAN S&T MARKET GROWS RAPIDLY

Wuhan HUBEI RIBAO in Chinese 28 Oct 86 p 1

[Text] On 12 October 1986, the Wuhan Amino Acid Development Corporation, with the help and mediation of the Wuhan technology market, agreed to transfer plastic whitener technology to the Municipal Solvents Plant. This is another item pursuant to the mid-September agreement between the Wuhan Institute of Technology on the transfer of technology on integrated circuit substrates formed under hydraulic pressure.

This technology transfer item raises the number of successful trades on the Wuhan technology market during 1986 to 101 with a contract value of 13 million yuan. The number of contracts increased 69 percent and the value of the contracts quintupled compared with the same period of 1985.

Rapid communication of information concerning technology buyers and sellers makes the Wuhan technology market vigorous. In addition to making full use of its relationship with correspondents in more than 100 cities throughout China, and staying in touch with the technical information exchange media, the market plans to organize during 1986 scientific and technical workers in scientific research units and in universities and technical schools in Wuhan. It disseminated 56 items of scientific and technical information to the factories and villages which resulted more than 20 successful transfers of technology in Hongqiao, Jingmen, Xiaogan, Badong, Hanyang and other counties and cities. After receiving sparkling champagne production technology provided by the Wuhan market at the beginning of the year, a fruit and wine factory north of Jingmen City won first place in the province for that type of product.

The Wuhan technology market calls upon customers in order to serve them better and thoroughly fulfills its responsibilities in the technology transfer process. Having won the confidence of both buyers and sellers, the market has been able to expand the scope of its technology exchange activities. The Yanji Petroleum Equipment Factory had difficulty in installing new equipment because it had few scientists and technicians and thus could not easily absorb new technologies. The Wuhan technology market, after signing the technology transfer agreement, immediately organized a group of scientific and technical workers who went to the plant to direct the design, processing, and adjustment of eight large hydraulic oil storage tanks. The tanks were soon used in production. The Wuhan market also worked on the technology for an entire plant

and for entire processes. During 1986 it won technology contracts from several units such as from a food processing factory in Rongxian County, Sichuan Province and from a ferric alloy factory in Badong.

The Wuhan technology market is strengthening its links with the open cities along the coast in order to encourage the export of technology and of commodities and to improve the work of the technology market. The Wuhan technology market has already established liasons in cities such as Yantai and Shenzhen. The Wuhan technology market, together with the Shenzhen Scientific and Technical Services Exchange Corporation held the "Shenzhen, China Conference on Trade in Scientific and Technical Commodities" and listed more than 1200 areas in which the technology of the Wuhan area was lagging, average or advanced. Business transactions have been made with factories and trading companies in Hong Kong and in Hong Kong for Wuhan aluminum alloy hydraulic pressure treatment technology and of gasoline combustion chamber technology.

12369
CSO: 4008/2035

PROSPECTS FOR LOW-ALLOY, ALLOY STEEL DEVELOPMENT

Beijing GANGTIE [IRON AND STEEL] in Chinese No 10, Oct 1986 pp 1-4

[Article by Zhuang Yi [8369 3085] of the Bureau of Iron and Steel, Ministry of Metallurgical Industry]

[Text] I. Achievements in low-alloy and alloy steel development during the Sixth 5-Year Plan.

Technological progress in every sector of the national economy in recent years has created new requirements for materials and created a steel shortage which is becoming steadily more serious. The metallurgical industry has made faster progress in low-alloy and alloy steel development. By the close of 1985, the production of low-alloy steel and alloy steel were 67.3 percent and 41 percent above their 1982 levels. The goals of the Sixth 5-Year plan were fullfilled ahead of schedule. The growth of low-alloy and alloy steel production spurred technological progress and technological restructuring in the iron and steel industry. It also increased the benefits to society of using steel and brought along with it a series of changes. These changes appeared in areas such as those discussed below.

1. Some new steel products were developed to promote the technological restructuring of the national economy and and to develop large technical equipment. The structure of the products of the iron and steel industry improved.

1.1 Railroad steel. Sixty kg track for heavy, high speed trains is widely used in laying down new track and in renovating old lines. Seventy-five kg track is being furnished for testing. Production lines have been built for 135 kg reinforcing bars for new railroad ties. The railroad department has ordered 2 million railroad ties for construction of Beijing to Guangzhou and the Shanxi coastal line. The extended life of these railway ties, according to preliminary estimates, could reach an economic benefit of 60 million yuan.

The weathering resistant plate and mould material used in railroad cars can now be furnished in sets in large quantities. These materials extend the useful life of the 1500 passenger and freights cars already constructed from 6 years to 12 to 18 years.

1.2 Reinforced steel used in coal mining. U-type steel for supporting mine shafts is produced in sets of 18 kg per meter, 25 - 29 kg per meter and 36 kg per meter in order to satisfy the requirement that the mine shaft's cross-sectional area be increased from 12 sq m to 16 sq m. Test production of a class D annular chain with a strength of 130 kg. was sucessful. When the annular chain series is complete, it will increase the intermittent load a coal conveyor can carry from 41 tons to 51 tons. Wear resistant light rails for mining can double the lifetime of the light rails. All of these products can be mass-produced.

1.3 Construction steel. Series of reinforcing bars and of steel wires are nearly complete. New 42-kg class-three reinforcing bars are ready for mass production. Compared with class-two reinforcing bars, these new bars can reduce the amount of steel used in industry and in construction by 7 to 20 percent. Lot quantities of of reinforcing rods produced to UK standards are now exported each year. Seventy-five kg and 95 kg class finish rolling fine wire reinforcing bars used in long spans, in large separations between columns in heavily loaded prestressed concrete structures and accompanying links and anchor gear are now in mass production. Steel savings realized by using these reinforcing bars instead of the cold rolled classes 2 - 4 reinforcing bars now used will be in the 20 percent to 40 percent range. China formerly imported high strength, low slack prestressed steel wire for 200 meter stayed-cable bridge spans; now this cable is manufactured in China.

1.4 Steel for ships and for oil drilling platforms. China can mass produce 32 kg and 36 kg high strength steel plate for ships which meet the standards of the International Shipping Classification Association. This steel is used in the construction of oceangoing freighters and of "Kantan No 3" oil drilling platforms. Z-vector steel has passed performance tests; it meets all international standards.

1.5 Steel used in oil pipelines. In addition to grades of steel plate of class X 50 and below, China can produce X 60 and X 65 steel plate which meet the specifications of the API (USA) in all respects. This steel plate has been used in building the oil pipeline between Anshan and Dalian.

Moreover, test production of special boiler plate (13MnNiMoNb) made by ultra-high pressure bubbling for 30 x 10^4 kW and 60 x 10^4 fossil fuel electric generating systems has been successfully produced. High pressure boiler pipe No 102 has been improved. Test production of weldable high strength steel plate for large processing machinery and weldable non-cracking steel plate for large municipal coal gas tanks (CF-60) has been successful and the steel plate is being supplied in lot quantities.

After key problems were addressed during the Sixth 5-Year plan, most of the specialized materials used by railroads, construction, coal and other sectors are mostly or almost entirely low-alloy steel. Production of low-alloy steel increased from 10 percent of all steel production in 1982 to 13.2 percent of all production in 1985.

2. The quality of alloy steel has improved in order to improve globally the parts of all types of machinery and to improve the characteristics of tools.

About 40 percent of bearing steel production is vacuum refined. This reduces its oxygen content from 30 to 40 ppm to below 20 ppm and raises the fatigue life of bearing steel by more than 50 percent. The carburized bearing steel produced during 1985 used in railroad cars are sufficient to change 20,000 railroad cars from lubricated bearings to roller bearings. The machine industry used miniature bearings produced in China. These bearings are exported to 34 countries and areas.

High speed machine-tool steel solved the problems of poor uniformity in carburized steels with a large cross-sectional area, in hot wires and in thin plates. These steels solved the problem of overly large carbonized particles in high speed wire, cracks on the surface, thermoplasticity shortcomings and brought these three steels up to the level of foreign products of the same type. Formerly, Chiense production of large knives, thin knives and small drills had long depended upon imported material. Domestic production of these steels earns $30 million annually in foreign exchange.

Ten percent of all spring steel production goes through powder and rare earth treatments which achieved the goal of increasing its fatigue lifetime by 20 to 50 percent. Three types of spring steel -- single face, double trench; and trapazoidal cross-section ribbon spring steel were developed to meet the needs of the automobile industry to change models and to conserve resources. Nearly all the several tens of thousands of automobiles manufactured by the Second Automobile Manufacturing Plant during 1985 used single face double trench steel. Compared with planar spring steel, this steel uses 10 percent less steel or about 3000 tons. Variable load face spring steel is exported to the United States.

One-half of all stainless steel is refined by a new method which does not involve a furnace. The capital investment required for this process is markedly lower, quality is higher, and production has increased by 70 percent over the level before the problem of stainless steel was solved. A new generation of low carbon and very low carbon stainless steel with excellent corrosion resistance and excellent polish characteristics have begun to be supplied to the petroleum, chemical, astronautics, aeronautics, and textile industries as well as to light industry.

Research on the problem of the narrow band of hardenabilty in gear steel which reduces the band of hardenability from 12 (HRC) to from 6 to 10 (HRC) has been confirmed. This extends gear life by 30 to 50 percent. Quantities of this new gear steel have been furnished to the Second Automobile Factory for testing.

Some key technologies which address tool steel problems such as high proportion of impurities, tropism and tempering stability can extend tool life by 30 to 50 percent. Annual production capacity has reached 4000 tons.

3. Master some new techniques and technologies in order to further the technological progress of the iron and steel industry.

3.1 Top to bottom top rotating furnace compound blowing technology has been popularized widely. In key industries, more than half the more than half the rotating furnaces have converted to blown technology. The quantity of steel produced during 1985 in China using top to bottom compound blowing technology reached 6.15 Mt. Progress has been made in the development of new types of brick ventilation, two channel air guns, and in CO^2 sources. The development and popularization of these new technologies increased the purity of steel produced in rotating furnaces, lowered alloy waste, promoted improvements in and modernization of Chinese rotating furnace techniques. These techniques create very favorable conditions for the development of rotating furnace low alloy steel technology. These advances bring China up to just an elementary level when compared with advanced countries abroad. China still needs to import and to absorb more foreign technology.

3.2 Absorbing powder metallurgy technology and gradually developing a complete Chinese system of producing new compounds. China has several dozen electric furnaces equipped with single powder tanks as well as several dozen more steel ladle powder equipment which can be used to produce low sulphur steels for oil pipes, oil pipeline tubing, drilling platforms, high pressure containers, automobiles. China not only has the technology to construct and entire production system for manufacturing 10-, 30-, 70-, 110- and 180-ton steel ladle powder equipment; it has also developed a fairly complete system of applications software. This technology is moving away from electric furnaces towards open hearth furnaces, rotating furnaces, blast furnaces foundries. Its popularization and deepening strongly affects the renewal of traditional smelting artisanship.

3.3 Non-furnace refining technologies are advancing rapidly. In recent years, China has built 13 different refining furnace systems including argon-oxygen furnaces, vacuum refining furnaces, steel ladle refining furnace, and vacuum deoxidizing furnaces. An 18-ton argon-oxygen furnace and a steel ladle refining furnace with a productive capacity of 0.1 Mt were built by the Chinese themselves and are operating in five plants at Taigang and Shanggang. The amount of steel that is produced outside the furnace each year increased from more than 30,000 tons in 1980 to 0.26 Mt in 1985. More than 100 types of steel have been refined with economic benefits of 100 million yuan. Further progress in and popularization of these technologies and of the powder metallurgy technology mentioned above will raise the quality of some varieties of Chinese steel to international standards.

3.4 A good beginning has been made in the application of immersion cooling control technology. This technology is widely used to improve the internal structure and the overall strength of steel bar threads, steel plates for ships, pipe steel, and bearing steel. A large quantity of steel was produced during 1985 using this technology.

3.5 Expanding the applications of advanced heat treatment methods. Applications of protective atmospheres have progressed from heat linked steel bands to steel bands linked during cooling, cooled linked plate, steel wire, water quenched material, water quenched tubing and heat linked plate. There are six roller type annealing furnaces used to improve the homogeneity of the organization of bearing steel and of stainless steel.

3.6 Progress in related technologies. Recently developed technologies include very strong graphite electrodes for the high current densities of very high power electric furnaces; production of spray smelting spray guns; and production of power spraying agent. These technology problems have existed for many years in the areas of low alloy steel welding materials and technology. New types of iron alloys, rolled ties, special fire resistant materials and their associated production skills and technology. Progress in these related technologies ensure that the new technologies and production skills will be popularized and applied.

4. Increase the ranks of metallurgical scientific and technical workers; accelerate the construction of the scientific and technological foundation of metallurgy.

More than 150 units and 3000 specialists in science and technology are investigating various topics in low alloy steel and alloy steel. Hard work has produced many valuable scientific results. Among these are the steel ladle blower buoyancy model developed by a group at the Dongbei Institute of Technology under assistant professor Xiao Ziqiang [5135 3419 1730]; establishing criteria for cracks in welds under Chinese conditions and formulas for predicting preheating temperatures by a Tianjin University group under professor Zhang Wenyue [1728 2429 6885], ending a long period of Chinese dependence on foreign criteria; using various rare earths to reduce the spread of hydrogen during the smelting of metals by a group at the Beijing Construction Research Institute under engineering professor Tang Paigang [0781 2143 0474]; and research on differences in equilibrium carburization values of high speed tool steel and theoretical work on processing superplastic materials.

China has constructed some laboratories which meet advanced international standards. Dongbei Institute of Technology, Beijing Iron and Steel University, Beijing Iron and Steel Research Institute and Shanghai Industrial University all have advanced powder metallurgy laboratories. These laboratories are staffed by 4 doctoral students, 26 master's students, and many researchers who are graduates of universities or technical schools who are studying problems in basic theoretical science as well as in applied technology. China's spray metallurgy laboratory has won some international fame; it has hosted two international conferences on spray metallurgy. The Beijing Iron and Steel Research Institute a national laboratory on controlling the cooling of links. Research at the institute proceeds on 40 topics on fundamental numerical measurements and technical modeling experiments in order to collect reliable numerical data upon which to base industrial production in the future and reference values for industrial techniques. The drill steel experimental station established by the Changsha Mining and Metallurgical Institute and the Fine Steels and Drill Steels Research Institute greatly advanced the state of drill steel research with its numerical model of drill steel rock drill life.

Progress in low alloy steels and alloy steels has brought in a new generation of higher quality iron and steel products, contributed to the development of industry, improved the structure of society's use of steel and has been very beneficial to enterprises and to society.

II. New Tasks for Low Alloy Steels and Alloy Steels During the Seventh 5-Year Plan.

Steel production should increase from 46.79 Mt in 1985 to 60 Mt during the Seventh 5-Year Plan. Production of low alloy steels and alloy steels should increase by 45 percent and 37 percent. International standards should be vigorously applied to product quality. We should continue to improve good products, promote the next generation of iron and steel products, and serve the technological restructuring of every sector of the national economy. Special attention will be paid to the uses of steel listed below.

1. A new generation of steel products should be developed for the upgrading of the tracks for the high speed rail system. During the Seventh 5-Year Plan, all the 60-kg and 75-kg heavy rails, weathering resistant steel, high strength steel railroad ties, and carburized bearing steel for the upgrading of the railroads for high speeds and heavy loads required should be provided.

2. A series of sets of steel for strengthening coal mine shafts should be supplied, including every kind of shaft support steel, hydraulic jack tubing, annular links, corrosion resistant rails, notched steel, and scraper plate steel.

3. Gradually increase the proportion of Chinese produced steel used by the petroleum industry. Using the old plant at Waqian and the production of oil pipe at the Baoshan Iron and Steel Plant, 0.4 Mt of oil pipe meeting API standards will be produced in 1990. At the same time, the oil and gas pipeline network will be completed and a series of sets of steel for oil platforms will be produced.

4. A number of new resources conserving products should be produced for the automobile industry such as non-adjusted steel, two phase steel, 42-kg automobile steel, and low strength corrosion resistant steel. Replacing adjusted steel with non-adjusted steel produces a savings in materials of 20 percent or more. The number of types of steel in series of high fatigue life spring steel and narrow hardenability band tooth gear steel. The quality of bearing steel should be improved so that it meets engineering requirements for heavily loaded automobiles, railway freight cars and so that 50 percent to percent of bearing steel production will meet advanced international standards.

5. Emphasize the development of steel reinforcing rods used in reinforced concrete as the principal type of steel used in construction. Develop prestressing technology as needed for the growth of the construction industry, develop highly elongated medium strength steel links, high strength steel wire and twisted steel wire. Develop cold formed thin walled steels, steel pipes and steel pressure plate according to the demand of the structure of light steel construction and curvature of a large structure produced by differences in the lengths of steel beams. In ordinary reinforced concrete structures, use new class three steel links instead of old class three steel links to conserve steel.

6. Develop steel for large construction projects. Study and develop 50 kg and over high strength welding structural steel (Welten 60 - 100) for large excavating equipment, large electric powered heavy trucks, high horsepower earthmoving equipment; welding non-cracking steel (CF steel); and wear-resistant steel for wear-resistant parts. This will gradually produce a series of Chinese manufactured engineering structural steel.

7. Develop our capacity for producing nickel-alloy steel for low temperature pressure containers for municipal coal gas projects, 0.3 Mt ethylene, chemical fertilizer, synthetic rubber, and liquified natural gas systems.

8. Develop low phosphorous, low carbon austenite stainless steel to meet the requirements of the petroleum, chemical and nuclear power industries in order to gradually supply a complete line of Chinese-made piping and plates. Chinese stainless steel production should change from principally titanium-alloy stainless steel to principally a stainless steel with a low phosphorous and very low carbon content which contains no titanium. Develop inexpensive stainless steel for food products; civilian use of gold, silver, copper, iron and tin; and for consumer electric appliances.

9. Build production lines and a large production capacity to furnish large quantities of non-magnetic stainless steel for television shadow mask steel bands, expanding alloys, flexible alloys, and bimetal alloys.

10. Continue to develop steels for high precision, long life, large tools. Produce a series of tool metal for cold working and hard working of malleable materials. Replace the 10,000 tons of tool steel now imported with Chinese production. Exploit the advantages of high speed tool steel and strive for greater exports.

3. The Principal Tasks for Fulfilling the Seventh 5-Year Plan.

1. Make a plan for developing low alloy steel and alloy steel. Rapidly bring the results of science and technology to the aid of production.

2. More research on the problems of low alloy steel and alloy steel.

a. Improve the characteristics of products developed during the Sixth 5-Year Plan in order to complete a series of products and to bring them into wider use.

b. Develop new types of products according to the needs of the national economy to develop new science and technology.

c. Apply new technology developed during the Sixth 5-Year Plan to improve the series of products, to create new technical processes, and to update traditional techniques.

d. Strengthen theoretical research which has practical implications.

3. Make sure that the best products are used, accelerate the pace of technical renovation, and build specialized production lines.

4. Open new technical markets to accelerate the dissemination and exchange of technologies.

5. Exploit China's advantages in natural resources and vigorously promote exports to earn foreign exchange.

6. Invest more in the development of human resources and knowledge.

12369
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STATISTICS REVEAL NEGLECT OF MAINFRAME COMPUTER DEVELOPMENT

Beijing BEIJING KEJIBAO in Chinese No 841, 12 Nov 86 p 3

[Article by Yu Zhijun [0060 1807 6874], Assistant Professor, Beijing Engineering Academy: "Appraisal of the Level of Computer Production in this Country During the 'Sixth 5-Year Plan' and Forecast for the 'Seventh 5-Year Plan'"]

[Text] The democratization of decision making is an important means by which to guard against major strategic decision making errors. The political and economic systems in this country at present are vertical technology state systems, and are typical information self-feedback systems. Because feedback systems are not independent, their functions regarding monitoring and correcting errors in decision making systems are rather weak and insufficient to prohibit major strategic decision making errors.

Based on the understanding just described, the Department of Management Engineering of the Beijing Academy of Information Engineering has established the "China computer market information public database," and with the support of that database has undertaken research into an evaluation of the level of development for the Chinese computer industry during the Sixth 5-Year Plan and forecasting for the Seventh 5-Year Plan. Results of that research show clearly that during 1980 of the Sixth 5-Year Plan, the level of comprehensive technology regarding small, medium, and large scale computing in this country (hardware, software, and applications) was some 15-20 years behind international advanced levels. During the period of the Sixth 5-Year Plan, this gap was maintained at 15-20 years, that is, it was not reduced. This is an extremely grim fact. The trend involving microcomputers is better, where the gap has been reduced to 4-5 years. Tables 1 and 2 show the statistics for the situations regarding development of small, medium, and large computing in this country and that for microcomputers, respectively.

We can see from tables 1 and 2 that as the quantities of computers in this country have grown, the rates of usage for small, medium, and large computers and for microcomputers have rapidly declined. While that stabilized for microcomputers in 1985, the situation for small, medium, and large scale computers has worsened; the levels of development for small, medium, and large scale computer investment has dropped dramatically as the quantities of installed computers have grown; the situation regarding development of

microcomputer funding sources has been just the opposite, rapidly improving as the quantities have grown. This shows that the situation regarding microcomputer applications has taken a turn for the better, while conversely that regarding small, medium, and large scale computing, and especially the situation regarding development and applications of large and medium scales, has worsened with larger quantities of imports. Ninety percent and more of small, medium, and large computers have no database support, nearly all are without remote communications network support, and many large systems costing tens of million of dollars serve as single tasking "large abacus" operations. We can see from forecasts in table 3 that the current surge in purchases of large scale systems is quite fierce. During the Seventh 5-Year Plan, throughout the country, economic systems, banking systems, information systems, civil aviation systems, insurance systems, tax revenue systems, all functionary sectors, and all economic regions have either already or are planning to import large scale computer systems. Their objectives are systems such as the IBM 4381, 308X, the Hitachi M-180, M240, the Fujitsu M150F, and the Wang VS300, or even larger systems. As the appetite gets greater and greater, taking such actions costs upwards of $10 million for a system with more than 10 medium to large computers as a core and some 1,000 terminals. However, some purchasing units do not even have computers to use that are minimally qualified for use or sufficient maintenance personnel, not to speak of core personnel. In addition to this, our communications circuits have simply never been tested for mainframe data transmission network systems. What the consequences will be with this attitude where each does things in his own way without regard to technical capacity and conditions, having at the same time tens of national and economic regional large network systems, has been little considered, if at all. This will quite possibly lead to a major mistake in strategic decision making, the consequences of that mistake appearing then during the Eighth 5-Year Plan after 1990. Based on our research, we offer warnings in this regard, hoping to attract attention.

Table 1. Statistical Table for Development of Small, Medium, and Large Computers in China During the Sixth 5-Year Plan

Year	Number of Installed Units*	Domestically Produced	Imported	Usage Rate	% of Computer Funding Sources for Development
1980	2,928	2,614	314	40-60	40
1982	3,819	3,300	319	20	20-30
1985	5,500	4,000	1,500	15	15

Table 2. Statistical Table for Development of Microcomputers During the Sixth 5-Year Plan

Year	Quantity Owned (units)	Usage Rate (%)	% of Microcomputer Funding Sources for Development
1980	600	100	25
1982	6,000	80	30-50
1985	110,000	25	75

Table 3. Marketing Forecast for Computers in China During the Seventh 5-Year Plan[a]

Year	Small, Medium, and Large Computers (units)	Microcomputers (units)
1986	1,031	59,620
1987	1,082	65,582
1988	1,190	75,419
1989	1,309	87,486
1990	1,440	101,484
totals	6,052	389,591

"a" indicates development figures from COMPUTER WORLD, the rest being statistics from the Database Research Office of the Department of Management Engineering of the Beijing Academy of Information Engineering.

12586
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TIANJIN GETS ADVANCED IMPORTED COMPUTER PRODUCTION LINE

Tianjin TIANJIN KEJI XIAOXI [TIANJIN SCIENCE & TECHNOLOGY NEWS] in Chinese No 4, 15 Apr 86 p 30

[Article by Wang Jingmin [3769 7234 3046]: "The Most Advanced Domestic Computer Production Line"]

[Text] The computer assembly line key equipment and exclusive technology imported from the United States by the Tianjin Municipal Computer Plant was formally approved by organizations of the Tianjin Municipal Economics Commission in December 1985.

The Tianjin Municipal Computer Plant is a specialized factory designated by the Ministry of Electronics to manufacture minicomputers and microcomputers. In order to allow this to become a major production base for micro and minicomputers in China, and to allow domestic computer production technology and quality to reach advanced international levels with competitive capacity in the international marketplace, the Tianjin Municipal People's Government resolved to allow this plant to import the computer production line.

The major equipment for this production line is: in-factory test equipment, insertion soldering equipment, component insertion, testing, and maintenance equipment, testing and maintenance equipment for peripherals, and equipment for reliability testing and guarantees. The chief imported technology is: production technology for 32-bit microcomputers and Chinese-character terminals.

This production line is advanced, practical, reliable, and long-lived. The majority of the equipment uses computer-aided testing and computer-aided manufacturing. Most of this equipment is among the first computer production equipment to enter China through the Coordinating Committee for Export Control (COCOM), and it is of an international advanced level for new computer plants of the early 1980's. It is quite adaptable, and through software we write ourselves, techniques may be flexibly revised. It can manufacture both the 0500 series and also the 0600 series of computers; it can manufacture both microcomputers and also minicomputers; it can manufacture large quantities of a few different products and also small quantities of many different types. Its reliability comes from the fact that the equipment used is international name-brand equipment, and the composition of the assembly line is constructed

under the principle of TQC process quality control, as well as from having anti-static facilities. This production line can become a testing center, maintenance center, and reliability analysis center for Tianjin Municipality. Its durability is evidenced in the fact that not only has it not become outmoded as computer technology has developed, but with software renewal it can continue to manufacture new types of computers that are even more powerful.

It has been revealed that this production line is the most complete, most advanced, and most universal among the more than 50 computer production lines that have been imported to China.

12586
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NUMERICALLY-CONTROLLED MACHINE TOOL SITUATION REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 2 Dec 86 p 1

[Text] After a year's bid solicitation efforts for an economical machine tool numerical control system, the work has been basically completed. At the national economical machine tool numerical control system development and applications technical exchange conference held recently in Xian, the appraisal specialists group proposed an idea for appraisal, believing that: products from the Nanjing Microanalytic Electrical Machinery Plant, the Changzhou Electric Machinery and Equipment Main Plant, the Xian Miniature Electric Machinery Institute, the Dalian Computer Applications Technology Institute, and the Xindu Electronic Instruments Plant each has its strong points and are foremost among the 48 firms that participated in the bidding. Based on the requirements of the bidding, the specialist group recommended that the five units unite their strengths and jointly design and produce a highly reliable, high performance, low cost, systematized numerical control system to be the final system to win the bid and to be made available to customers.

More than 200 hundred came from various research units, higher institutions, mining and industrial enterprises throughout the nation, and at the conference they exchanged experiences in using microelectronics technology to transform machine tools. It was their unanimous opinion that after the two national applied microelectronics technology conferences held in 1984 and 1985 in Nanjing and Chengdu, respectively, the use of microelectronics to transform machine tools had developed. At present, the technica performance of economical numerical control systems continues to improve; the number of transformed machine tools has clearly increased, and the scope of transformation continues to expand. According to preliminary statistics, during the period of the Sixth 5-Year Plan, there were approximately 1,500 converted machine tools, and in just 1986 that could reach more than 3,000. Many units have gained gratifying economic results from this, which has hastened the pace of transformation.

Actual practice has shown that using microelectronics technology to transform existing machine tools has the advantages of small investment, quick results, is easy to use, and is an effective way in which to quicken the technological transformation of traditional industry in this country. It is understood that of the existing 3-million plus machine tools in China, 700,000 could be

converted during the Seventh 5-Year Plan. To stably and practically do this work well, we must further improve the reliability of numerical control systems. We should use national standards to continually develop new products that have good performance, are low in cost, have good economic results, and have a high degree of commercialization. On this occasion, the conference required that all areas undertake directional transformation in accordance with system characteristics and the particular circumstances for each, which transformation can be done in a workshop, the workshop sections concentrating on transformation. We should establish technical service organizations for machine tool transformation, and do a good job at technical and installation, maintenance, and training efforts. At the same time, we should also intensify the development of new products for economical numerical control systems to be used in machine tools.

12586
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FUND TO SUPPORT POST-DOCTORAL RESEARCH ESTABLISHED

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 10 Dec 86 p 4

[Text] China recently formally established a post-doctoral scientific research fund to encourage and support research by post-doctoral researchers who have outstanding talent and good potential research ability. This fund is intended to help these researchers to smoothly carry out their research program and to quickly become high level experts.

The regulations covering this scientific fund were discussed yesterday by the National Committee on the Management and Coordination of Post-Doctoral Reseach Stations. The regulation stipulates that anyone who began post-doctoral work at a post-doctoral research station before the end of August 1986 may apply for funding to the office of the National Committee on the Management and Coordination of Post-Doctoral Research Stations or to the State Science Commission Scientific and Technical Workers Agency. Judgement of applications will henceforth be done twice annually during the months of February and August. The research worker who wins a grant has the right to decide how the grant is to be spent; the grant can be used to purchase instruments and equipment needed for research, experimental materials and library materials, improvements in the laboratory, hiring research assistants and for participation in relevant conferences in China or abroad.

Informed sources report that China will encourage outstanding researchers to do post-doctoral research in remote border areas of China. Over the past 2 years the conditions of researchers at research station at Shenyang, Dalian, Changchun, Harbin, Xian, Lanzhou, Chengdu and Guiyang have improved; moreover the researchers there have been given some additional compensation. Moreover, everyone who received a doctorate recently is given the same chance to win a grant. No distinction is made between those who won their degrees abroad or in China, or between those who did their studies as a full-time student or while they were employed.

12369
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FOREIGN S&T MANAGEMENT TAUGHT AT DALIAN MANAGEMENT CENTER

Beijing RENMIN RIBAO in Chinese 2 Dec 86 p 3

[Article by correspondents Chen Xinggui [7115 5281 6311] and Sun Maode [1327 2021 1795]: "Learning From the Strengths of Others; The China Industrial S&T Dalian Training Center Survey (first of a series)"]

[Text] Are the industrial S&T management theories, experience and methods developed in the United States in the context of U.S. society applicable in China? This is the question which the people at the Dalien S&T Management Training Center are most interested.

How should that question be answered now that 6 years have passed? A plant manager who participated in the first class of the Dalian S&T Management Training Center, Comrade Chen Shinan [7115 0013 3948], now vice-director of the Anshan Iron and Steel Company gave us his views. After his period of study at the Center, Chen believed that he had learned much. Many American methods are very useful for use to compare to Chinese practices; many can be adopted directly.

The comrades at the training center gave us some material which had been written by plant managers and directors on what they had gained and on their experiences. For instance, plant director of the Dalian Textile Factory Ning Peiying [1337 0160 5391], was attempting to implement the responsibility system in the plant when she was taking the course. By applying the management theories and methods learned at the Center, she was able to expand production and export products so that the value of this year's exports are double what they were in 1985. Li Guocai [2621 0948 2088], vice-director of the Beijing Municipal Cotton Textile Dye Industry Corporation used his knowledge of financial management, accounting controls, marketing, and management economics to rapidly resolve long term problems in the corporation's management and use of capital. Yang Peisong [2799 3099 2646], secretary of the China Astronautics Association, applied his lessons to the concrete situation of his own unit and made several suggestions on promoting modern management methods. Ren Jinlie [0117 6855 3525], vice-chairman of the Chongqing City Economic Committee made the most representative comment: "The greatest benefit was opening me up to new ways of thinking".

The responsible comrades and workers of the training center told us of what they had learned. Studying the managment theories, experience and methods of the advanced countries has given the managers of Chinese enterprises the market concept, the information concept, the profitability concept, the finance concept, the entrepreneurial concept, the concept of the strategic policy etc. The importance of these concepts to improving the quality of Chinese management cadres and the invigoration of Chinese enterprises cannot be overestimated. Naturally, management science must be digested just as all other S&T imports are digested, studied to adjust them to China's concrete situation to make them applicable to China.

The graduate students at the China Industrial S&T Management Dalian Training Center, while studying U.S. industrial S&T management experience also gain a good understanding of the pedagogy and method used to develop managers in the United States. They feel that the "Case Study Method," strategy policy modeling practice and other techniques are worth comparing with Chinese methods.

What is the "Case Study Method"? In short, it is a method of improving the ability of students to analyze and make decision on actual problems by the introduction, analysis and explanation of a case. This method is generally used in U.S. business schools. Experts are responsible for developing a case study. The author of the case study goes personally to the company under study and discovers the problem by observing everyday activities. The case study is written like a novel: it is vivid and complex, with disturbances and sudden changes, recurring contradictions, fascinating, and getting its readers involved in the outcome. The case study should also develop the student's thinking, and ability to analyze and to solve problems.

The Dalian Training Center makes another strong impression in the minds of its students. The contents of the lessons, the pedagogy, and the examinations are closely related to the goal of developing talent step by step. Similar to "Teaching by the Case Study" is "Strategy Modeling Practice." A businessman normally confronts strategic problems. The teacher divides the class into groups; the members of the groups are assigned responsiblities such as CEO, production director, financial director, marketing director, information director, etc. The teacher gives all the groups identical business conditions. The groups compete and all of the management directives are entered into a computer. The competition continues through several rounds which represent several years of competition and a final score is prepared which compares the strengths and weaknesses of the management of each group. Using this pedagogical method helped students improve their ability to integrate their knowledge and deepened the students' understanding of how to use harmonously each function of business management. The exercise deepened the students' understanding of competition and how to harmonize the different sectors of the enterprise. It reinforced the idea of working together for a common goal. Naturally, actual business conditions are more complex than simulations; however the function of the simulation is clear and easy to see. It is analogous to the simulator training pilots and ocean navigators receive.

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SHAANXI TECHNOLOGY TRADE SITUATION REPORTED

Tianjin JISHU SHICHANG BAO in Chinese 2 Dec 86 p 1

[Text] Over the past 2 years, Shaanxi Province has upheld the principle that science and technology efforts will orient towards economic construction, and it has put great effort into restructuring the science and technology system, into opening up the technology markets, and into promoting the commercialization of scientific and technical achievements, in all of which it has made outstanding progress.

They first began with science research structures. Aside from those that were not qualified, a great number of units in 48 development institutes have implemented the technology contract system, and four among them have instituted funding independence. The majority of agricultural science research units and a number of institutes of social welfare and basic technology have increased their economic income through the various means of transfer of rights to technology and technical services, from which they have brought in certain economic results. A new type of high-quality fire retardant material supplementing a domestic void--low pore rate electronically fusible corundum, after its evaluation last year has an annual production of 700 tons, newly increased output value of 2.10 million yuan, and increased tax revenue of 700,000 yuan. A new variety of distant hybridized wheat, "Xiaoyan No 6," was awarded a national first prize, and it has already been disseminated over an area of 24.6 million mu and yield per mu is 700-1,000 jin, for a total increase in wheat yield of about 12 billion jin, with a value of more than 200 million yuan.

Shaanxi Province has actively promoted the development of technology trade, and it held two large technology achievement trade fairs last year in Yangling and Xian, respectively, where the total volume of transacted items reached more than 4,700, for a total trade amount of more than 460 million yuan. This has promoted a mutual understanding between production and science and technology units and an exchange of technical skilled personnel. For industrial technology trade fairs alone, agreements were reached whereby 309 scientists and technicians would be exchanged, and they have fulfilled the task of training more than 4,800 specialist technical personnel. Income for institutes at the prefectural and cities level or above throughout the province reached a total of 63.807 million yuan, within which income of a technical nature was 13.109 million yuan, which is 20.5 percent of the total

income. The provincial Institute of Printing Technology, which has only been in existence for 6 years, last year had an income from the transfer of rights to achievements of 520,000 yuan. Over the past 2 years, 110 technical achievements have been disseminated and applied in Shaanxi Province.

Shaanxi has an abundance of science and technology power and advanced research equipment, but it is primarily concentrated in the national defense science and industrial system and in units of ministries of the central authorities that are stationed in Shaanxi. In breaking through regional and sectoral boundaries, they have developed technical cooperation and have also achieved outstanding results in the areas of science research, education, and production associations. More than 1,200 associations have been established throughout the province, and these associations are in the process of developing from the short-term to the long-term, from the loose to the cohesive, and from the urban to the rural.

12586
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MEETING OF NOTED GUANGDONG SCIENTISTS REPORTED

Guangzhou NANFANG RIBAO in Chinese 30 Dec 86 p 1

[Article by Xu Jindan [6079 6855 0030]: "Next Year, Restructuring of the Science and Technology System in the Province Will Make Great Strides"]

[Text] It has been learned from the Guangzhou Regional Conference of Well-Known Scientists held yesterday morning by the provincial science and technology commission that next year restructuring of the science and technology system in this province will take great strides forward. The policies that emphasize giving prominence to broadening and invigorating research structures and scientists and technicians permits scientists and technicians to contract to research units, to initiate civilian-run research structures, allows them to go to small and medium-size towns and to the countryside to contract to small and medium-size enterprises and town and township enterprises, and even to create and run enterprises.

At yesterday's conference, Lu Zhonghe [4151 6988 7729], director of the provincial science and technology commission and director of the Guangzhou branch academy of the Chinese Academy of Sciences and of the provincial Academy of Sciences, said that based on the spirit of the party Central Committee and the State Council regarding the major deployments for national restructuring of the science and technology system next year, they brought together the actual conditions in this province to preliminarily plan that for restructuring of the science and technology system in this province, we will adopt the following measures: 1) will encourage research organizations that are affiliated with the province, that are of various central ministries stationed in Guangdong, and from higher institutions to establish associations of various formats with state-run, collective, and town and township enterprises, and that former preferential policies enjoyed by research units would be maintained without change; 2) will encourage the scientists and technicians in all science research units to collectively or individually contract to provincial, municipal (prefectural), and county arranged "spark plan" projects, as well as providing preferential policies; 3) will encourage and support scientists and technicians (including those who have resigned or retired) to leave their former units and contract or hire out to enterprises, and to establish various forms of organizations for technology development, technical services, and technology trade; 4) will support scientists and technicians from the Guangzhou prefecture to go to the Zhu Jiang delta region

to engage in spare-time occupation activities as "Saturday engineers" under the condition that this not harm the rights of the group, and will protect their legal income; 5) for provincial, municipal (prefectural), and county research institutes where neither management nor results have been good, scientists and technicians will be allowed to contract collectively or individually through bidding methods; 6) preferential treatment will be given to those scientists and technicians who contract to enterprises or who engage in technology development, technical services, or technology trade in the mountain regions, along the coast, or on Hainan Island; at a certain age, they will be allowed to return to their former areas to settle down.

More than 60 well-known scientists from the Guangzhou region, such as Pu Zhelong [5543 5832 7893], Gao Zhaolan [7559 0340 5695], Huang Yaoxiang [7806 5069 4382], Li Yuesheng [2621 1471 3932], Gao Youxi [7559 3945 4406], and Liu Zhenqun [0491 2182 5028], attended the conference yesterday. In their speeches, everyone had many enthusiastic suggestions regarding science and technology efforts and the restructuring of the science and technology system in this province.

Responsible comrades from the provincial commissions, the provincial people's congress standing committee, the provincial government, and the provincial CPPCC, such as Guo Rongchang [6753 2837 2490], Zheng Guoxiong [6774 0948 7160], Liu Weiming [0491 4850 2494], Luo Tian [5012 1131], Zhong Ming [6988 2494], Huang Youmou [7806 0645 6180], Luo Xiongcai [5012 7160 2088], Zeng Zhaoke [2582 2507 4430], Kuang Ji [0562 0679], and Li Chen [2621 6591], attended yesterday's conference. Guo Rongchang and Kuang Ji spoke. Comrade Guo Rongchang spoke on problems in the three areas of the reliance of Guangdong economic construction on science and technology, the historical mission of Guangdong science and technology circles, and the renewal of concepts in science and technology circles. He stated emphatically that the party central committee and the State Council have resolved that next year there will be great strides in science and technology system restructuring, and that the integration of science and technology with production will be promoted in terms of organizational structures, the personnel system, and operational mechanisms. As far as scientists and technicians are concerned, they will not only be able to engage in science research, but will also be able to understand management, learn operations, and have a concept of a commodity economy. They will be both scientists and can also be entrepreneurs, which is certainly a great conceptual change. The science and technology system of the past was a closed system, and scientists and technicians have become accustomed to emphasizing research, papers, and reputation, but have paid no attention to economic results and practical value. To be in keeping with restructuring and to keep up with the development of a commodity economy, scientists and technicians will undergo a conceptual renewal.

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STATISTICAL ANALYSIS OF HAIDIAN S&T COMPANIES

Beijing KEYAN GUANLI [SCIENCE RESEARCH MANAGEMENT] in Chinese No 1, Jan 87 pp 1-7

[Article by Ke Tizu [6143 7344 4809], Beijing Research Center for Science and Technology Management: "A Force in Science and Technology that Cannot Be Overlooked; A Survey Report on Collective Science and Technology Structures in the Haidian District of Beijing"]

[Text] This article gives an overall description of the situation regarding development of collective science and technology structures in the Haidian District of Beijing, the economic and social results obtained by them, as well as the management characteristics of these structures and some of the problems currently existing. It is also considered that these structures are a new form of ownership that has emerged during the restructuring of the science and technology system, and that it is a force that cannot be overlooked.

I. The Basic Situation for Collective Scientific and Technical Structures in the Haidian District of Beijing

There are 32 higher institutions concentrated in the Haidian District in the northwestern suburbs of Beijing Municipality. There is the Chinese Academy of Sciences, the Academy of Agricultural Sciences, various ministries of the state, and more than 80 institutes affiliated with Beijing Municipality. There are more than 45,000 scientists and technicians and teachers at the higher institutions, as well as more than 100,000 graduate students and undergraduates, so the intellectual density is at the forefront of the nation. However, the more than 100 small to medium plants in this district are quite out of step with the situation just described due to backward science and technology and the very lowest production forces. What is hopeful is that this situation has begun to change in the course of the system restructuring.

There has appeared during the restructuring of the economic and science and technology systems a group of collective science and technology structures, commonly called local scientific and technical organizations. They function as aids to the close integration of science and technology with production, and have become a new force that cannot be overlooked for the front lines of science and technology and for the four modernizations. Because of its unique technological advantages, the Haidian District has established over the past

few years a large group of collective science and technology structures that represent an engagement with new technologies. In numbers, they constitute nearly one-half of this sort of organization in Beijing Municipality, and are playing a major role in the economic construction of Haidian and of the capital.

The first collective science and technology structure in Haidian District was founded in January 1980, and by the end of April 1986 there were 380 science and technology organizations of all sorts registered with the Office of Industry and Commerce. Of those, 91 had public ownership and public operations, 10 had public ownership with collective operations, and the remaining 279 were collectively owned and collectively operated. Among the 289 having collective operations, 43 were run by the Chinese Academy of Sciences and its institutes, 26 by institutions of higher education, 118 locally, 15 by societies and institutes, 38 by various ministries, 37 by large company systems, and 2 by areas normally outside the capital.

This survey has been only of the 289 collectively operated firms just mentioned, from which 229 of the survey forms were returned, meaning that 79.2 percent of these have been surveyed. Among these, 141 are valid, and of the remainder 12 firms went public, 21 are engaged in commerce and are no longer science and technology organizations, 16 never opened after registration or ceased operations, 12 moved from Haidian District, 14 went bankrupt, and 13 merged. Among the 60 forms not returned, 4 refused to fill them out, 27 were searched for without success, and in 29 the manager was away and could not comply.

1. Personnel Categories and Structures

Among the 141 firms for which we have statistics, there are a total of 6,816 people involved in the operations, the composition of which is shown in Table I. Full-time and part-time scientists and technicians at these companies have come from the following areas: 1) unemployed or retired scientists and technicians; 2) personnel separated from their units; 3) people who have quit their jobs; 4) scientists and technicians who are idle in society; 5) surplus personnel released from science research units.

2. Scope of Business Operations

The businesses that have been developed are rather broad ranging, and are characterized by engagement in new technology development. Among the 141, 61 are involved with computers, biology, automation technology, and medicine, 28 are involved with the general technological business of television, energy, machinery, engineering, acoustics, and optics, 35 are engaged in the occupations of materials translation, agriculture, forestry, animal husbandry, foodstuffs, science, education, and culture, and the scope of business for 22 was not clear.

It was discovered during the survey that about 15 percent of the current businesses began operations smoothly and have good prospects for development, about another 15 percent had a difficult time getting started and for various

reasons are faced with bankruptcy or cessation of operations, and the rest are normal.

Table1. The Composition of Personnel Structures for 141 Collective Science and Technology Organizations

Personnel Component	Total Number and Proportion	Personnel Structures	Total	Proportion (%)	Subtotal
full time personnel	2,747 (40.3%)	high-level	207	7.5	
		mid-level	589	21.4	
		beginning	331	12	1,127
		no rank	1,620	58.1	1,620
part time personnel	2,122 (31.1%)	high-level	328	15.5	
		mid-level	835	39.3	1,352
		beginning	190	8.95	
		no rank	769	36.2	769
otherwise unemployed youth	1,947 (28.6%)	permanent	550	28.2	550
		temporary	897	46.1	
		contract	337	17.3	1,397
		other	163	8.4	

II. The Quality and Results for Haidian District Collective Science and Technology Structures

The economic and social results generated by the Haidian District collective are very difficult to calculate for various reasons, so statistics have been done just for the conditions actually supplied by the 141 firms with the more completely filled out forms. Many items were not completed by each firm, but it may be affirmed that the actual quantities certainly exceed this statistical data.

1. The Situation Regarding Funding Sources

Owing to the fact that set-up modes are not the same, their funding sources for the initiation of their businesses are not the same, either. According to statistics from a sampling survey of 96 firms, primary sources for 51 firms have been from assistance and compensated allocations from units, the funding amounts being 13.3888 million yuan, or 25.73 percent of the total funding amounts of 52.0396 million yuan; for 45 firms, primary sources were individual

investment, borrowing, and loans, total amounts for which were 38.642 million yuan, or 74.27 percent of the total funds.

In recent years, on the basis of paying back the investments just described, these collective science and technology structures currently have assets of 90.7394 million yuan. Within that, fixed assets were 25.3979 million yuan, or 27.99 percent of the total; assets in circulation were 63.9806 million yuan, or 70.51 percent; low value consumer goods for exchange were worth 1.3609 million yuan, or 1.5 percent.

2. The Situation Regarding Output Value and Income

The proportions of gross output values and net profits generated by them over the past 3 years are shown in Table 2. It may be seen from that table that about 23 percent of gross income for these collective science and technology structures comes from science research, the transfer of rights to technologies, and from technical services, while income from production has risen annually and that from trade has declined constantly. Per capita generated output value has reached more 41,000 yuan, and per capita generated profits have reached 6,000 yuan.

3. The Situation Regarding State Shares of Profits Is Rather Complicated

Five of the firms are completely exempt from taxes, or 3.6 percent of the total. The majority of taxes paid to the state are industrial and commercial taxes, management taxes, construction taxes, environmental taxes, transportation taxes, and energy taxes. A minority are derived from income taxes and operations taxes. According to statistics from 105 firms, the total amount of taxes paid in 1985 was 58.354 million yuan. Of this, industrial and commercial taxes were 60.6 percent, management fees were 20.5 percent, energy, transportation, and construction and environment taxes were 6.8 percent, while income taxes were 5.8 percent, and operations taxes were 6.4 percent.

Table 2. Table of Individual Items for Production Value and Net Profits

year	gross output value (million yuan)	output values by individual items and proportion thereof of gross output value (in millions of yuan)						net profits (million yuan)
		research income	tech. sales	tech. service	sub-total	trade income	produc. income	
1984 (31 firms)	35.89	0.108 0.3%	5.096 14.2%	2.423 6.75%	7.627 21.3%	26.918 75%	1.31 3.65%	5.8572
1985 (109 frms)	117.107	3.064 3.3%	11.655 9.95%	11.594 9.9%	27.11 23.15%	81.506 69.6%	8.432 7.2%	19.7132
1986 (Jan-Mar) (68 firms)	217.57	1.066 4.9%	1.262 5.8%	2.785 12.8%	5.113 23.5%	13.859 63.7%	5.113 12.8%	6.5971

4. The Situation Regarding the Continuance of Projects

Their methods of project continuance are not the same as with public units. To use the 1,259 projects in hand as an example, 30 percent were owing to their own connections, 52.1 percent were sought after, 16.4 percent were jointly arranged, 1.4 percent were commissioned by the state, and only 0.1 percent have been projects with outside interests. The ways in which they complete their tasking are flexible and varied, and using 1,660 projects as an example, 50.2 percent were independently completed relying on their own scientific and technical strengths, while 15.6 percent were accomplished jointly with other units.

5. Professional Capacity

According to statistics from 100 firms, since their founding they have engaged in more than 3,700 professional activities, the composition of which and situation regarding project levels are shown in Table 3. It can be seen from the table that the collective science and technology structures are primarily engaged in science and technology development and consulting. Projects for institutes of the collective science and technology structures are largely topics in urgent need of resolution in the contemporary technology markets. According to incomplete statistics, more than 70 percent have been effective in gaining results. In a sampling survey of only 22 firms, there were direct results won in the sum of 29.17 million, the collective science and technology structures also trained a large amount of skilled personnel for society, which according to a sampling survey of 60 firms, over the past few years more than 22,000 people have been trained. The Kehai firm alone has held 108 study classes in all areas of the country, training more than 7,000 people. In 1985 they held 56 technology lectures free of charge, training nearly 3,000 persons.

6. Economic results

They have made use of the high intellectual levels of the Haidian District to make contributions in engagement in new technical industries, and have accomplished as well some research achievements that have had great economic and social results. More than 40 collective science and technology structures are involved in new technical industries such as computer applications, development, and installation, and according to incomplete statistics have marketed and developed more than 2,000 microcomputers. Their output value for 1985 exceeded 120 million yuan, giving rise to formation of an "Electronics Street." An all-China microcomputer applications exhibition attracted both domestic and foreign attention, and leading comrades of the Ministry of Electronics Industries also praised it, saying that our work over several years that we have wanted to do but have not been able regarding microcomputer applications and dissemination efforts has now been begun by the "Electronics Street" of Zhongguancun. The district government feels that they have laid the foundation for the formation of the distinct industries of Haidian District--new technology industries. At an all-China conference on the problem of knowledge-intensive areas, this area also received much attention,

being considered as possibly forming blocs of high technology industries and making contributions to the construction of a "Science Industrial Park."

For example, the Kehai New Technologies Development Center formed an intermediate testing plant to disseminate 32 research achievements of the Chinese Academy of Sciences, allowing research achievements that had been accumulating for years to be transformed into production forces; they provided help in the construction of 9 small factories in the Haidian District, which in little more than a year gained more than 3.9 million yuan in results, also finding work for 300 people; and they transferred an oil conservation technology to the Anshan Iron and Steel Works, which in 1 year saved 460,000 yuan in oil. To clear up a situation where at Qinghua University there were too many generals and not enough soldiers, the Haihua New Technologies Development Center readied a complement of graduate students and school graduates as assistants for some professors, they opened various channels, and succeeded in developing more than 40 scientific and technical achievements; for Professor Mao Yuhai [5403 0060 3189] they provided the personnel, funds, and materials so that within a half year he had successfully developed the advanced technology of "laser target shooting," for which he won a special prize of 30,000 yuan from the Headquarters of the General Staff. The M-2024 Chinese-English printer developed by the Sitong Company replaced the Japanese Toshiba model TH-3070. Each unit will save $400 in foreign exchange, and this technology alone has saved $1,200 [as published] in foreign exchange. The computer room designed and installed for Beijing University by the Jinghai Company was praised by both domestic and foreign experts, and the quality was high and expense low. There many examples of this sort, all of which we will not list here.

Table 3 Table of Venture Proportions and Levels of Research Projects

Venture Structure	Research			Technical Services			Trade
Proportion of Each Item	Total 1,249 (33.8%)	Basic Research 2.7%		Total 2,181 (59%)	Consulting 77.7%		Total 270 7.2%
		Applied Research 33.3%			Repair, Tech. Sale 10.5% 11.8%		
		Developmental 64.1%					
Level of Research Topics	Internationally advanced	In the Domestic Forefront	Fill a Domestic Void	Advanced Municipal Level	Patent		Municipal Award or Higher
	16	139	71	29	6		27

7. Social Results

On behalf of society, they have taken care of a large number of unemployed youth, training them into construction skilled personnel "proficient in their field." According to statistics from 86 firms, of 1,947 unemployed people given employment 550 were determined to be workers, or 28.2 percent, and there

were some companies that sent some of the school graduates who were trained to vocational schools for more training. For example, Jinghai funded the training of 40 vocational school students, and a number of other companies arranged work for a small number of disabled personnel to do what they were capable of. According to incomplete statistics, 27 companies gave support to society to the extent of 511,000 yuan, the major portion being used in restoring the Yuanming Park and constructing elementary and middle schools. Five firms provided assistance in the sum of 18.92 million yuan to support other economic entities. As for example Jinghai, which provided a total of 1.6 million yuan.

In summary, the development of collective science and technology structures in Haidian District has been inseparable from the policies of the system restructuring, unique geographical conditions, and the support of the Haidian District government, and has also been largely affected by its own management characteristics and the forms of the new systems.

III. Management Characteristics of the Haidian District Collective Science and Technology Structures

The collective science and technology structures are a new form that has emerged during restructuring. They are both independent regarding aspects of personnel, funding, and materials, and also have support, especially in bringing technology, trade, and production together. Their management is characterized in the following manner:

1. They practice the management responsibility system, with a clear management hierarchy.

Managers have great autonomy regarding personnel, finances, and management. Their management hierarchies are generally two-level responsibility systems made up of the manager and the project head. The levels are distinct, responsibilities and authority are clear, and this is characterized by quick decision making and high efficiency.

2. They have as leaders science and technology personnel who both understand economics and also understand management.

The nature of integrated science research, production, and marketing determines that their leaders must have capabilities in those three areas. The advantages to this are: expert heads are accurate and quick in decision making. For example, the leadership of companies like Jinghai, Kehai, Sitong, and Xintong in the past have always been scientists or technicians, they have studied the laws of economics, and through years of tempering they have been provided with a certain management ability, which has allowed the companies to prosper and develop. Because the leaders at particular companies lack economic management experience, their company businesses are faced with crises.

3. They implement the responsibility system where "five are rolled into one," where responsibilities and authority are clear.

Their research and development efforts are implemented by science and technology through a responsibility system that in accordance with market information "sets its own topics, organizes freely, determines its own plans, supplies its own funding, and finds its own customers." The responsibilities for scientists and technicians are to ensure the completion of tasking on time, as well as to realize results, they have the authority to freely employ people and freely allocate funds, and everything takes as its standard the attaining of very good economic and social results.

4. In business is implemented a "coordinate process" of services, with attention paid to strengthening lateral relations

The forms of associations of collective science and technology structures give them the capability of a "coordinated process" of services including information, science research, development of applications, production, marketing, and feedback, and there is no "wrangling" in the business. They pay close attention to lateral relations, which is exemplified in: 1) an enhancement of relations with customers and with other research units, which aids in the feedback of market information and in the enhancement of real technical strength; 2) relations with research personnel involved in specialties have been strengthened, so that on the one hand there can be reliance on them to provide timely, accurate scientific and technical knowledge and market reports, while on the other hand they can be relied upon to be technical reserves, who when the need arises can be called upon for technical consulting. This not only coordinates problem solving, but also promotes the movement of skilled personnel and intellectual forces.

5. They implement the allocation principle of "compensation according to ability," smashing the "common rice bowl."

Standards for remuneration are not determined solely through type of work, age, and rank, but rather are determined by the degree of contribution to the company and the degree of ability. Therefore, people can work at the highest efficiency, striving to make even more contributions. According to a sampling survey of 63 firms, funds allocated to staff in 1985 were 4.463 million yuan, or 15.08 percent of total profits. Within this sum, wages w e 9.46 percent and bonuses were 5.62 percent. Some 3.0873 million yuan were used for staff benefits, or 10.44 percent of total profits. The highest salary for a month was 434.58 yuan, and the lowest was 25 yuan; the highest monthly bonus was 324.50 yuan, and the lowest was 5 yuan.

6. Other Characteristics

They are also characterized by an emphasis on real results over form, by simple personal relations, a flexibility in economic dealings, and by resolution of the concern for staff difficulties at home and insurance for staff (a minority of companies).

IV. Current Problems

1. Conceptual Problems

These are manifest in two aspects, one being their perception of themselves in regard to their work, and the other being the recognition of these units in society. For example, for whoever cannot keep up with trends in the restructuring, there is insufficient understanding of this new type of system; a failure to recognize the economic position of intellectual labors and the value of intellectual commodities; insufficient appreciation of the importance of the integration of science and technology with production and of the circulation of technical commodities; a belief that scientists and technicians have no spare time, and that they cannot have a second job; a belief that collective science and technology structures have undermined public units; a belief that collective science and technology structures are profiteering middlemen in science and technology, and therefore an unclear understanding of their function; the old idea that "cultured people have no regard for wealth, and those who do are not cultured people" is still common; they have little desire for engaging in risky ventures, and are concerned about trouble back at home.

2. Problems With Their Management

A. It was discovered during the survey that some companies had no personnel, no funds, no operations area, and no scope of business, in other words, that they are just "briefcase companies"; or that some are engaged in commercial activities while "flying the flag of science and technology"; or that the address as registered is simply undiscoverable, and no one knows anything about the management units. There are no units responsible for structures of this sort, and they are simply a mess.

B. Many science and technology structures have moved from their original addresses, or have ceased operations, or have changed to general commercial activities, or have merged with other firms. This situation is not understood by pertinent management departments.

C. Some collective science and technology structures are indistinct from their former units regarding personnel, funds, and materials, and are actually "little treasure houses" for these units; certain public units have taken a portion of funds to allow some old, weak, sick, and disabled personnel to find their own ways, which is just not the way to run scientific and technical companies.

D. There is no way to implement party and group relations, no way to develop organizational activities, and the Party and League members of some units must go to three different locations for the regular activities of their organizations.

E. The post evaluations for technical personnel in these organizations cannot be implemented, which affects their enthusiasm and the development of academic activities, and which affects the movement of skilled personnel.

F. For a portion of their technical achievements, requests for evaluations are made in their districts, some are made to their managing departments, but for some there is no one responsible. Could these latter be made the responsibility of district science and technology commissions?

G. Many of the organizations have rather many business activities outside the country, but channels for approval have not been open. After some approvals, the original intention has already been lost, and some of these things have affected the reputation of our country.

H. When some companies have initiated large significant projects, funds have been insufficient, and they have been difficult to get off the ground; or, after doing so, they have been difficult to complete. We have four suggestions for this: 1) institute open bidding and the sharing of benefits from achievements; 2) from now on, science and technology commissions should solicit a certain amount of money from collective science and technology structures in order to ensure the smooth progress of projects with major economic and social results; 3) help to open up normal channels for loans, and the state planning departments should provide assistance for research topics that have enormous economic results and outstanding social results; 4) under the supervision of relevant departments, issue stocks and collect funds from society for scientific and technical development.

3. Management Problems for Collective Science and Technology Structures Themselves

A. Internal management within many structures is confused, especially financial management. Financial personnel lack training, there are no strict management systems, and in some cases all the money has disappeared.

B. The conditions involving personnel structures are rather complicated, the great majority of scientists and technicians engaging in their work wholeheartedly, but there is also a minority that has problems to varying degrees regarding thinking and quality. Some people have made mistakes and certain ones have taken up illegal practices, all of which cannot be divorced from their internal management and ideological education efforts.

C. The scope of operations for some businesses is too broad, they have no specialist characteristics of their own, and there are also problems with violating the technical rights of the former units.

4. Problems with Restructuring

A. Collective science and technology structures do not need state funds when undertaking research and development, their risks are greater in scientific and technical development, and therefore the collection of 8-level progressive taxes, income taxes, and operations taxes can affect their existence and development. An appropriate tax proportion should be taken under consideration.

B. In keeping with relevant provisions, collective science and technology units where the proportion of school graduates exceeds 60 percent are exempt from income taxes for 3 years. But the educational level of school graduates is low, and scientific and technical knowledge and production technologies are not suited to the needs of scientific and technical development, for which reasons the proportions cannot be excessive, while in addition a rather long training process is necessary. They hope to lower the proportion of school graduates needed for exemption from taxation.

C. The transfer of rights to technologies and technical services occupy certain proportions within the income of collective science and technology units. The State Council and Ministry of Finance have clearly provided that the portion of income for scientific and technical units that is derived from technical services is not to be taxed. But collective scientific and technical units currently still share the remunerations described above.

D. The problem of "shifting" income tax. For example, after party A purchases 20,000 yuan worth of products from party B, after development and the supply of software, there has been an expenditure of 25,000 yuan. Tax departments tax party A on income as figured at the 25,000 yuan value, while actually party A has only generated 5,000 yuan worth of output value. In this way, the income tax on the 20,000 yuan output value of party B has been shifted to party A. They feel that this method of taxing income is not conducive to scientific and technical development.

V. Preliminary Estimates for the Future for Development

Whether for the economic construction of Beijing or for the four modernizations of this country, collective science and technology structures in the Haidian District have played a certain promotional role, and have made many contributions to the prosperity of the local economy and to changing the district industrial structures, especially.

They have been an important supplement to public science and technology structures, have allowed science and technology to cater to economic construction, have rapidly transformed scientific and technical achievements into production forces, have invigorated the technology markets of the capital, have promoted the formation of high technology groups, and have promoted the development of small to medium enterprises and town and township enterprises. They have primarily used the potential of higher institutions and research unit scientific and technical strengths, have opened new channels for the movement of skilled personnel and intellectual forces, have undertaken courageous explorations on the part of science and technology system restructuring in this city, and have provided beneficial experiences. Over the past few years, they have undergone the hardships of starting up businesses and have braved the social elements to finally develop and mature, becoming in the process a scientific and technical strength that cannot be overlooked in construction of the capital.

The qualities of collective science and technology structures in the Haidian District are not the same, each has its characteristics, and for this reason only a general estimate can be made of their development trends.

1. A minority of scientific and technical structures that are strong in science and technology and have higher levels of knowledge will use the Haidian District advantage of concentrated intellectual forces, knowledge, and technology, and focusing on development to serve the high technology in this country, will constitute rising new industries in high technology.

2. Some scientific and technical structures, taking public units having strong science and technology as technical reserves, have a certain autonomy regarding personnel, finances, and materials. These structures are appearing as collectives, are undertaking scientific and technical development, as well as the dissemination and application of scientific and technical achievements, and have become windows on the special zones of public units and for the policy of opening to the outside.

3. On the currently existing basis, some science and technology structures have undertaken wide-ranging lateral relations, and have joined together to form new types of associated entities for wide-ranging science research, production, and operations.

4. Some science and technology structures that are weaker in technical strengths and have no technical reserves will focus on "trade," will use "technology" to assist, and will cater to small-scale enterprises and town and township enterprises, engaging in general technical services.

5. Some science and technology structures will change into general units that are purely commercial or purely production oriented due to lack of power in undertaking scientific and technical development or for various other factors.

6. Some "briefcase companies" and some "little treasure houses" for public units will be rectified and eliminated as management is strengthened and as policies are perfected and implemented.

In summary, this new creature that is the collective science and technology structure must be continually perfected and developed, and we should allow them to function fully in the economic construction of the capital and in this country's four modernizations.

12586
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OPTIMISTIC VIEW EXPRESSED ON S&T RESTRUCTURING RESULTS

Beijing KEJI RIBAO in Chinese 1 Jan 87 p 1

[Text] At this auspicious moment as a timely snow promises a good harvest, we welcome in 1987.

The year that has just passed was a good year for the frontlines of science and technology in this country. Abiding by the principles of consolidation, assimilation, supplementation, and improvement, the restructuring of the science and technology system in this country has advanced stably. In this year, the party Central Committee and State Council issued complementary policies having to do with science and technology allocation management, with establishment of the national natural sciences fund commission, with expanding the authority of research organizations, with promoting the rational movement of scientists and technicians, and with making the most of the function of specialist technical personnel who are unemployed or retired. There were many scientific and technical achievements, and the many scientists and technicians and management personnel have begun to establish a concept of science that corresponds to developing trends in the restructuring. The principles of a commodity economy have been respected, technical achievements have become commodities of a special state in circulation in society, which not only do not meet with opposition but instead have gained legal guarantees. Some accomplished scientists and technicians have left the institutes and have left the higher institutions and gone to the vast mountain regions, towns and townships, and enterprises, where they have given full play to their intellects and talents, and a new spirit is in the process of forming. That economic construction must rely upon science and technology while scientific and technical efforts must cater to economic construction is a truth that has been verified in practice, and one that is being more and more accepted by the vast science and technology and economic circles, that is gradually becoming self-conscious knowledge. The situation in which science and technology and economic construction have been separated has changed greatly, and a trend is currently underway for their integration.

1987 will be the second year of the Seventh 5-Year Plan, and is an important year for the intensification of the restructuring of the science and technology system. The prominent focus this year will be doing a good job with the two "liberations," namely, the liberation of research organizations and the liberation of scientists and technicians. The goal here is in the further promotion of the closer integration of science and technology with economic development. Government departments will separate the responsibilities for governing and research. Adjustment of the organizational

structures in research organizations will enhance research organizations, and especially the lateral relations between research organizations of the technology development type with enterprises or with enterprise groups, including merging with enterprises or enterprises groups. Some development type science research organizations for which it is inadvisable to merge with enterprises or enterprise groups may become professional technology development centers after careful selection and reorganization. Some may become the technology development departments of small to medium enterprises or their technology service centers. Some may join with design and engineering units to form complete engineering contract companies, etc. Research organizations engaged in socially beneficial endeavors will also break through departmental ownership, striving to increase income through the process of serving society.

For liberated scientists and technicians, an important measure is to permit scientists and technicians to depart from research organizations to assume responsibilities in small to medium enterprises in cities and towns or in the villages, initiating and running organizations for technology development, technical services, or technology trade of various forms of ownership.

For liberated science research organizations and liberated scientists and technicians, the key is in "liberated." There can only be life with letting go. To grasp research organizations tightly in the hands of administrative organizations will foster the concepts of dependence and "eating from the communal pot," with the result of a loss of vitality. We want to break up the old ideas that disdain enterprises and entrepreneurs. Many vivid examples have shown clearly that some science research organizations have had poor records for a long time but have changed their outlooks after integration with enterprises, not only enabling enterprises to increase their results, but also bringing a new lease on life to their own organizations. When skilled personnel are crowded together with no opportunities for movement, the technology of which they have charge cannot be used to its best, cannot be transformed into production forces, and this will thus constitute a waste of skilled personnel and technology. When scientists and technicians become a part of enterprises, they both contribute strength to the enterprise and also find ample scope for their own abilities. Currently, a group of new type socialist entrepreneurs is emerging in this country that both understands technology and can also take direct control of funding and are good at operations. When technology and funds combine to form a single entity, under the scientific operations of these new entrepreneurs, technology and funding are both revitalized. The economic reconstruction of the modernization of our country is in urgent need of a large number of this kind of entrepreneur, and we should actively foster and support their maturation, providing them with excellent conditions to create and to start enterprises. This is because our economic ascent needs them.

This new year will be a year of vitality, allowing us to more self-consciously engage in the mighty torrent of the deepening restructuring to win an even greater victory.

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BEIJING RESEARCH UNIT RESTRUCTURING PROGRESS REPORTED

Beijing RENMIN RIBAO in Chinese 6 Jan 87 p 3

[Report by Jiang Hanzhen [5592 3211 4631]: "System Restructuring for Beijing Science Research Units Advances Steadily, While Working Modes for Funding Resources Exhibit Obvious Changes"]

[Text] In comparing funds allocated for science research for research units affiliated with the Beijing municipal science and technology commission against the income of those academies and institutes, that ratio has climbed from the 1:0.4 of 1983 to the 1:1 of 1986. Among income structures organized by the academies and institutes, income from technology has also risen, from 10 percent to 40 percent.

During the past 3 years, the Beijing municipal science and technology commission has paid complete attention to the restructuring of the allocation system for science research units and to the opening up of the technology markets. Beginning in 1984, on the one hand there has been an annual budget decrease for operating expenses of science research units, and on the other research personnel have been encouraged to leave the institutes and cater to the economy and to production. There have been test sites for new examination indices for science research personnel within the science research units. Prominence has been given to an examination of the level of scientific and technical achievements and to the social and economic results after transformation into production forces. By better directing the attention and focus of scientists and technicians toward the needs of enterprises and society, this has placed the final appraisal of science and technology achievements into society for checking and evaluation.

Through the efforts of the many scientists and technicians, 3 years of restructuring has produced clear results, and there have been quite startling changes in some research units:

-- The structures of sources for science research unit tasking and funding have undergone obvious changes, and have already changed from tasking "with a hand extended to those above" to primary reliance on lateral commissions and cooperation. Comparing 1983 and 1986, the number of research topics handed down from above grew 29 percent, while projects laterally commissioned through enterprises grew 64 percent.

-- The level of research topics has improved greatly. Achievements from units of the municipal Environmental Protection Institute, the municipal Chemical Engineering Academy, the municipal Plastics Institute, and the municipal Institute of Radio Technology have been evaluated as attaining international and domestically advanced levels. Laterally commissioned tasking has developed from single item technology development to project contracting.

-- Science research units are in the process of changing from the science research model to research-development-operational models. Research units have everywhere strengthened science and technology development and operations systems. The volumes of technology trade that are primarily concerned with the transfer of rights to technologies and technical consulting have grown 20 times in nearly 3 years. Associations of different degrees established by factories and enterprises grew about sixfold from 1984 to 1986. Around some research units there have begun to form embryonic colonies of small to medium enterprises and town and township enterprises. Some have begun to enter enterprise blocs, and some have seen results the very year they form associations. The carbide materials industrial model tools experimentation plant newly opened by association of the municipal Powder Metallurgy Institute and the Huairou County was in operation after just 5 months.

-- Research units have obtained a group of achievements having clear social and economic results. According to rough statistics for 182 items among them, their created output value for 1986 was 120 million yuan.

-- Approximately 20 percent of municipal-affiliated research units have adopted different modes by which to develop international science and technology cooperation, and according to statistics on 50 among them, they have generated about $500,000 worth of foreign exchange.

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STUDY ON S&T INVESTMENT EFFECTIVENESS IN SHANGHAI

Beijing KEJI RIBAO in Chinese 4 Jan 87 p 1

[Article by Ling Bingmo [0407 4426 2875] and Yu Jing [6657 7234]: "Science and Technology Investment Is Absolutely Necessary for Developing Our National Economy"]

[Text] The Shanghai Municipal Science and Technology Commission gathered its strength in 1985, and using a systematic test and evaluation method did a status analysis on science and technology problem solving and a study of economic results. After more than a year of effort, this project recently passed an appraisal by specialists. Results of the study have shown that science and technology investment in problem solving projects during the Sixth 5-Year Plan led to enormous economic and social results, and that it is absolutely necessary for developing the national economy.

During the period of the Sixth 5-Year Plan, Shanghai Municipality commissioned 25 science and technology problem solving projects in all, within which were 559 topics, and in which 1,268 units participated. After a systematic testing and evaluation of 150,000 status data using scientifically rigorous methods, the results showed that: regarding the status of problem solving, the situation regarding completion of projects was excellent, with a success rate of 91.6 percent; of the 362 topics completed, 289 of them are being applied in problem solving units, 47 topics have been sold to various relevant units in Shanghai, and 43 topics have been sold to provinces and cities outside Shanghai; 10.5 percent of the problem solving projects attained internationally advanced standards, 19 percent of topic portions attained international standards, 35 percent of achievements were in the front ranks domestically, and 21.5 percent of achievements attained domestically advanced levels.

Regarding the economic results of scientific and technical problems solving, research results have shown that: among problem solving projects already completed, 71 percent have brought about economic results; the total investment in problem solving of 142 million yuan has been completely recovered, and a total of 63 million yuan of investment was used for the renewal and purchase of equipment; the gross output value of problem solving projects as applied in problem solving units and as disseminated throughout the Shanghai region has been calculated at 1.046 billion yuan, or a 637 percent increase in output value for every 10,000 yuan investment.

This topic has made forecasts for the economic results of the Sixth 5-Year Plan problem solving achievements during the period of the Seventh 5-Year Plan. If these achievements are applied in the Shanghai region, and if they are applied throughout the country, annual output value will be 16.79 billion yuan.

This topic has also given full affirmation to the establishment of science and technology problem solving topics in Shanghai Municipality during the Sixth 5-Year Plan," to the organization of problem solving contingents, and to the formation of science research/production associations, and has as well analyzed problems regarding the rate of commercialization for problem solving achievements. The factors affecting achievement commercialization are: there are few "risk" topics, many "insured" topics, topics lack universality, and there is a low rate of direct application; scientists and technicians are indifferent toward the concept of the commercialization of technology; technology markets are still at a preliminary stage of development; the current methods for the appraisal of achievements easily lead to the divulging of secrets, evaluation commissions have become on-the-spot meetings for technology dissemination, and thus commercialization has resulted in the loss of safeguards.

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THEORETICAL PROBLEMS IN S&T PROGRESS DISCUSSED

Beijing KEJI RIBAO in Chinese 5 Jan 87 p 3

[Article by Li Xiuguo [2621 4423 2654], Zhang Shuqin [1728 3219 3830], and Yang Meidong [2799 2734 0392]: "Some Theoretical Problems in Science and Technology Progress"]

[Text] The Significance of Science and Technology Advances

There are currently two ways of saying this: some people speak of this as scientific and technical advances, while some say technology advances. There is no fundamental difference between the two, that difference just being that in the former the sense of science is included, while in the phrase "technology advances" the primary emphasis is on technology, which is suitable to the situation involving enterprises. Generally speaking, the meaning of "enterprise science and technology advances" may have three different interpretations.

The first is where by science and technology advances is meant the advance of enterprise production technologies themselves, that is, advances in technique, equipment advances, and advances in testing methods. According to this, they concentrate their efforts on technology itself, and are enthusiastic about work on technology renewal, technology transformation, new technology development, and the importation of technology. In the second, by enterprise science and technology advancement is meant the advance of enterprise production methods and of product development capacities. According to this interpretation, enterprises not only emphasize the question of advances in technology itself, but also pay close attention to the building up of product development capacities and to efforts at strengthening development and market analysis.

In the third interpretation, by enterprise scientific and technical advancement is meant advances in production methods, development methods, management methods, and marketing methods. It is also felt that only by having a complementary development of these four aspects can enterprises obtain real economic and social results. To one-sidedly develop a particular aspect would cause scientific and technical advances in an enterprise to be placed in an imperfect state, where other aspects might become restrictive

forces, and the function of science and technology advances could not be fully realized.

These three differing interpretations show that our concept of science and technology advancement is still rather confused, and that the interpretations are rather one-sided, stuck in standards of the past. It is our belief that if we are to promote the development of enterprises through advances in science and technology, we should first of all undergo a change in concept.

How are we to accurately understand advances in science and technology? We believe that by advances in science and technology are meant advances in two aspects: one is advances in the material means of production, that is, advances in hardware; the other is improvement in the intellectual levels of production, namely, advances in software. Regarding the former, because the natures of enterprises are not the same, there will be differences in the manifestations of these. In general, these include advances in technical equipment (production equipment and equipment undergoing intermediate testing), techniques and methods, detection methods, and the forms of after-sales service. By the latter is meant operations concepts (including operations strategies), management capabilities, market forecasting, the capacity for innovation and quality of technical personnel, as well as an improvement in worker operations and in the ability to accept new technologies. Therefore, science and technology advancement is a systems concept, and is a process of social activity. This is composed of many factors, and it is in motion in the large system that is society, comprehensively making the most of its results.

This system is largely made up of the seven links that are operations and decision making, management systems and efficiency, research and development capacities, technology and equipment, the levels of techniques, marketing means and after-sales service, and personnel training. Advances in science and technology are where there are advances in all these seven aspects, where there is a mutual accommodation and mutual stimulus, where they constitute system functions, and does definitely not mean advances in only one or two aspects. Conceptual transformation means to change from just being concerned with single advances in equipment and techniques to being concerned with systematic advances in equipment, techniques, operations management, development capacity, marketing, and training. It is only this systems concept that can guarantee results from advances in science and technology. The results from advances in science and technology for some enterprises have not been good, the key being in the fact that there has not been a systems concept, that they have rejoiced in handling only one aspect. But where one link cannot get support from another link, the result is that advances in one aspect offset the defects in the other aspects, overall results become less, even being equal to zero or a negative value, and we must be especially watchful for this.

Of course, to emphasize the systems viewpoint and systems usefulness is certainly not to say that there must be an equal capacity for usefulness in the factors of all seven aspects. The systems concept stresses their relations, and emphasizes the mutual influences of these seven factors. Whichever aspect is neglected, that aspect will prove restrictive because it

is not complementary. For example, by neglecting training, this will affect results because of the inability to grasp new technologies. By neglecting the improvement of the means of operations, then this could lead to a decline in economic results due to an inability to provide raw materials, or because of excess surpluses, or because there is no market for products. Advances in science and technology mean advances in four aspects: advances in science and technology themselves, advances in management methods, improvements in the quality of scientists and technicians, and development of the cause of science education.

The Motivation Behind Advances in Science and Technology

There was a viewpoint in the past that felt that advances in science and technology were only restricted by efforts in science and technology themselves, that they are primarily supported by the rules of science and technology efforts, that as long as laws of enterprise science and technology work are made clear, by compliance with these laws science and technology will naturally be able to advance. We do not completely agree with this outlook. We feel that advances in science and technology are part of science and technology efforts, and at the same time are also part of economics efforts. They are a component of economic activities, and they are affected primarily by the laws of economics, since the laws of developments in science and technology are secondary. Whether or not factory directors respect advances in science and technology is chiefly determined by whether or not economic activity is necessary, and is only secondarily affected by the individual quality of a faccory director. This is because the science and technology efforts of enterprises primarily serve production, and the factory director will create the conditions for the development of whatever technology is needed by production; the promotion of advances in science and technology requires investment, for without it there can be no advances in science and technology; advances in science and technology are deeply affected by the economic situation of enterprises, and generally speaking, the expenses necessary for advances in enterprise science and technology must be provided by the enterprise itself, aside from the national investment in major national projects; competition is the motivation for advances in science and technology, and although competition is primarily manifest as tests of strength with products in the marketplace, in reality, this is a competition among the aspects of quality, cost, and after-sales service.

It may be seen from this that the primary aspect of activity among advances in science and technology is economic activity, and its motivation comes primarily from economic needs and market situations. Advances in science and technology must naturally follow the rules of science and technology efforts, as for example where the selection of topics must coincide with trends in science and technology development; there must be sufficient science and technology information; people engaged in science and technology advances should be of a higher scientific accomplishment; the characteristics of mental labor should be respected; efforts in reports and information should be respected, etc. Although these are not the things that primarily determine the progress of science and technology, we cannot transfer the entire set of working methods from the science research methods over to science and technology efforts in the enterprises.

Leadership Methods for Progress in Enterprise Science and Technology

First of all, there is the method by which to gradually change administrative deployments. There are currently many economic leadership organizations that each year determine a group of projects in technology dissemination, technology innovation, and technology transformation, that using administrative methods allocate these to companies in all professions, which are then passed on by the companies to affiliated factories. To arouse enthusiasm in enterprises for disseminating these projects, a certain amount of funding is allocated with the projects. This method in which administrative means pass down tasking is fraught with abuses, the reasons being simple: whether or not technological innovations and technological transformations projects can be realized must depend upon the real economic and technological conditions in a factory, and this must be suited to local conditions for it cannot rely upon administrative directives.

Second, improve the management of importation projects. Because currently the major portion of foreign exchange is separately controlled by leading economic departments of the central authorities, the sources for funds needed by enterprises to import foreign technology and to utilize domestic technology are from two different channels, with no ability to supplement one from the other. Enterprise applications to import foreign projects and to utilize domestic technology are made separately to different organizations, so in this way when enterprises are deciding how to choose between the two, it will not be because one of them is more beneficial to the enterprise, or which one has the better results, but rather for which one money can be obtained. That one for which money can be obtained is the one chosen. For these reasons, we recommend that changes in deployment methods be made from top to bottom regarding projects for technology transformation, technology renewal, and the dissemination of new technologies. From now on, aside from major technology transformation projects that are under the direct management of economic leading organizations, the majority of general projects should be determined by the enterprises based on the actual conditions of the enterprises themselves; leading economic organizations can recommend new technologies to enterprises, can provide technological information and reports for them, can provide technical consulting, and can provide help in the selection of projects by enterprises. By reducing the component of administrative directives, this will increase the consulting service component, providing enterprises with autonomous selection authority and allowing a project to truly make the most of results. Establishing funds for advancements in science and technology will change the funds accompanying project allocations in the past to basic funds. Basic funds can be divided into the three forms of subsidies, no-interest loans, and low-interest loans to be provided to enterprises. After enterprises have decided upon projects, they can apply to the management departments of science and technology advancement funds in accordance with their own economic capacities and the results from the project; fund management departments will do project evaluations by establishing evaluation groups with the help of specialists, and will as well make decisions regarding whether or not to provide support and by what means to provide that support. For the period for the implementation of the project, fund management departments have the authority to monitor the

conditions of fund usage, and when they discover improper uses, such as embezzlement, they may stop that support. In this way we can ensure that the limited funding is used in the most effective projects.

Establish unified evaluation organizations for importation projects. These organizations should be composed of financial departments, such as economic leading groups and foreign exchange management, and of science research units, and should uniformly evaluate the importation projects as requested by all departments and enterprises; applications must be made jointly by the utilizing departments and the research departments, reports should be together, and applications from only one party should not be accepted in order to guarantee that there is sufficient capacity for assimilating the technology. At the time of application approval, funds should also be provided for absorption and assimilation, the funds to be earmarked for their special purposes only.

The formulation of preferential tax policies to reward advancements in science and technology will give tax exemption or reduction preferences to projects that benefit the improvement of science and technology levels in this country, projects such as technology renewal, technology transformation, the dissemination of new technologies, the development of new products, and the importation of technology.

The Basic Path for Advances in Enterprise Science and Technology

Enterprises promote advances in science and technology through various means. This is both a theoretical and a practical problem. If this problem is not resolved, efforts at progress in science and technology can only remain at the level of slogans, and cannot become real actions.

Technology is a commodity in an intellectual state and its value lies in circulation. If a technology remains only within a unit or in the minds of one or a few people, the realization of its value will be limited or will not be manifest. Only when these technologies are shifted to other units or to the minds of others, and when these units or individuals use them in production, can their value be transformed from a smaller scale or from a potential state to a larger scale or to an actual state, and can they become material forces. Therefore, only if technology can be shifted in place and time can it create wealth or can it be better able to do so. This has given us an inspiration, namely, that if enterprise science and technology is to advance, it must promote the occurrence of technology transfer. In particular, three types of transfer should be facilitated: 1) transfer from abroad or from other domestic areas or from other units to the unit in question; 2) shift from the minds of some people to the minds of others, where the technology can be grasped by more people; 3) shift from an industry or product to another industry or product. Science and technology progress is realized in just these kinds of transfers.

Technology transfer is conditional, for if conditions are not right, then it cannot fulfill its role. Various other methods must also supplement each other, and must mutually support the formation of one system. Only with

various methods in use together can comprehensive results be realized, and on this question we should guard against concentrating on one thing only.

Speaking from the point of view of conditions, the following points must not be lacking. Technology transfer requires investment; we must have those who are able to grasp technical knowledge; we must have reliable materials or component parts supply channels and stable product sales markets; advancement in science and technology is an extremely complicated task, especially when things in science and technology are changing every day, in this day of numerous market changes, where external environments change so much, and where the internal environment is also complex, all of which requires that we arouse the enthusiasm of participating personnel and provide enterprises with full autonomy.

How we are to realize progress in science and technology is something in which we currently lack experience, which we must accumulate and explore. It is most important that we effect a renewal of concepts.

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1986 ORDNANCE MINISTRY ACHIEVEMENTS

Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 6 Jan 87 p 3

[Text] It is shown in a statistical document from the State Science and Technology Commission that the ordnance industry that has seemed so quiet has actually been the sector from which most inventions have come. It has been ranked first among 71 ministerial commissions and provinces, municipalities, and districts throughout the country. During the period of the Sixth 5-Year Plan, the ordnance industry received a total of 105 awards, 12 of which were second class, 53 were third-class, and 40 were fourth-class. At the "Second National Exhibition of Inventions" held in 1986, the ordnance industry exhibited 37 items, winning three gold medals, four silver medals, and three bronze medals.

These award-winning items have largely been applied in production lines, and have created quite remarkable economic results. The SF-501 optics instrumentation anti-gas agent developed by units of the Wuxi Huguang Optical Instrumentation Plant has had an important use value for gas protection in optical instrumentation. Regarding the microscope exported by the Shanghai Optical Instruments Plant, it used to be that after the product had been exported abroad, 85 percent of them would give off a poisonous gas, but after using SF-501 all have checked out to specifications.

The second-class prize-winning TW-1 inorganic adhesive manufacturing technique and bonding technology developed by He Xiaoxian [6320 1321 0341] of the Hubei Jiangshan Machinery Plant has gone into production in 28 provinces, municipalities, and autonomous regions, which has resolved a key problem in quantity production technology. Rough estimates are that the savings will be worth 50 million yuan and more. At present, this technical product is still selling well in the marketplace.

The salt-bath furnace fast starting method developed by people like Zhang Qinghe [1728 1987 7729] of the Shanxi Changzhi Red Star Machinery Plant has transformed traditional starting methods both domestically and abroad, saving from 30 to 50 percent on electricity, and reducing the starting time by 60 percent. Currently, the Ordnance Ministry has more than 400 units, and there are more than 1,000 salt-bath furnaces throughout the country that have implemented quick starting, saving nearly 8 million yuan in electricity.

The forged-part blanks induction-heating furnace and heating technique developed by units of the Academy of Design No 6 of the Ordnance Ministry won second prizes for inventions, and this was the first forged-part induction heating furnace in this country, and its basic performance is up to international standards, and has also saved more than 8 million yuan in investment.

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COMBINED RESEARCH, PRODUCTION GROUPS FORMED IN JILIN

Changchun JILIN RIBAO in Chinese 12 Jan 87 p 1

[Report by Wang Lichen [3769 4539 6591]: "There Are 210 Research-Production Associations in This Province"]

[Text] This province has actively promoted the restructuring of the economic, science and technology, and educational systems, newly developing 121 research/production and research/teaching associations in 1986, so that now the 89 associations throughout the province in 1985 have developed into 210.

There are five kinds of these associations, and they have also gained outstanding economic results. Jilin University and the Taoan County Pharmaceutical Plant No 3 adopted the modes of joint investment, joint operations, joint sharing of risk, and joint sharing of profits in founding the Jilin University Tao'an Associated Pharmaceutical Plant. They have been associated for a year now, and have already developed nine new products, realizing a profit of 2.13 million yuan.

The second type is the new products development model. The association formed by the Changling County Pharmaceutical Plant and the Changchun Academy of Chinese Medicine. They jointly developed four new products, allowing the enterprise to turn loss into profit in one blow.

The third type is the association to actively develop research and production between similar industries, that is trans-regional, and that transcends ownership. As for example the Changchun Institute of Test Machinery that organized a total of four associations, like the "Zhonglian Test Instruments Company" and the "Changchun Test Machinery Research and Production Association" constituted from 29 major manufacturing plants in the same industry and 3 institutes, which have implemented a coordinated process of contract services from design, development, equipment installation, debugging, to putting into production.

The fourth type is the absorption and assimilation model. Jilin University and the Changchun Institute of Applied Chemistry made use of the advanced instruments and detection means owned by the institute to form the Changchun Center for Analyzing and Testing Imported Equipment, which has opened up to society in all directions, both improving the rate at which advanced

instruments are initiated, and also resolving technical difficulties in production.

The fifth type is the resources development model. Centering on the development of special produce resources of the Changbo mountain region in the eastern part, 32 research/production associations were organized, and in addition, the "Xinkai He Hongcan" and the "Changbo Mountain Hongcan" were developed at an internationally advanced level.

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TECHNICAL ADVANCES IN SHIPBUILDING INDUSTRY REPORTED

Duesseldorf HANDELSBLATT in German 31 Mar 87 p 20

[Article by Tong Yuan: "Keels Laid for Modern Container and Ro-Ro Ships at Chinese Dockyards"]

Shipbuilding in China goes back a long time. The oldest shipyards in China--the Jiangnan Shipyard in Shanghai--celebrated its 120th anniversary in June 1985. Most of the large and mid-sized shipyards in China, including the Dalian Shipyard in Dalian, Shanghai Dockyard and Zhonghua Shipyard in Shanghai,look back over a 60 year history.

With the expansion of the national economy following the establishment of the new China, the government also set up new construction offices for the R&D of ships and ship parts. Throughout the course of several five-year-plans, many shipyards and plants related to shipbuilding and the industries that supply it were established. Specialists and administrative personnel were trained work at universities, technical colleges and technical schools for work in the shipyards. At the same time, more than twenty research institutes were created for ship design and shipbuilding technology.

In September 1963, the State Council established the Sixth Ministry for Mechanical Engineering. This umbrella organization was responsible at that time for the overall administration, planning and development of the shipbuilding industry in China. In the 1970's and at the beginning of the 1980's, great progress was made in China in the development of the shipbuilding industry. At docks along coastal areas, new slips were built for over 10,000 tdw. Outdated shipbuilding facilities were modernized and new facilities were purchased for engine works. In May 1982, the Sixth Ministry for Mechanical Engineering was dissolved. All organizations, shipyards, plants and institutes were united together with shipyards, factories and institutes of the Ministry for Transportation in a new corporation, the China State Shipbuilding Corporation (CSSC), Beijing.

As the central office for the Chinese shipbuilding industry, the CSSC is directly subordinate to the State Council. Plants and institutes which belong directly to the CSSC are located in 21 cities, provinces and autonomous territories of the nation. The CSSC owns 26 large and mid-sized dockyards. These yards are equipped with 82 building slips, including 15 large slips of over 10,000 tdw, 28 docks and floating docks. The overall shipbuilding capacity of the CSSC amounts to 1.2 million tons, and the production capacity of diesel motors is 2.5 million

hp. Sixty-six modern factories are directly subordinate to the umbrella organization of the CSSC, 33 of which produce diesel motors, auxiliary engines, valves, propellers, castings and forgings. In 33 additional factories, navigational devices, precision instruments, batteries and other mechanical products are manufactured.

The research, development and technical areas are extensive and oversee the design and construction of ships of all types, of shipyards, ship installations, shipbuilding technology, information and documentation. For a long period after the founding of the PRC, the basic task of the Chinese shipbuilding industry was concerned with the development of the national economy, the build-up of national defense and water transportation, as well as meeting the needs of the Chinese navy and transportation requirements.

Steady Increase in the Number of Different Types

The equipment of the Chinese Navy is produced essentially by domestic industry. Since the beginning of the 1960's, China has itself been able to design and build marine vessels of various types. At the present time, it is possible in China to construct merchant ships such as freighters, multipurpose freighters, container ships, ro-ro ships, self-loading ships, fully refrigerated container ships, tankers, coastal passenger ships, dredgers, research ships, surveying ships and off-shore platforms, as well as tugs and work boats for offshore platforms and floating docks. In addition to such commercial craft, submarines, ocean-surface vessels and special vessels of various types are also built.

The management principle of the CSSC is directed primarily at meeting domestic demand. However, the corporation is also involved in export trade as well, carrying out transactions of all kinds, including business unrelated to shipbuilding. At the beginning of the 1980's, ships built in China gradually appeared on the international shipbuilding market.

The technological exchange between Chinese and foreign shipbuilding experts has been greatly intensified. From 1978-1980, twelve license agreements were signed with foreign firms. By the end of 1986, the CSSC had concluded license agreements and contracts for joint production. The tonnage of new ships built between 1981 and 1985 at CSSC shipyards amounted to 2,715 tons. The output of production of diesel motors from the engine works of the CSSC during the same period amounts to 2,449 hp; of this figure, 740,000 hp were built under license by international diesel motor manufacturers.

In these five years, China delivered seven offshore platforms. At the same time, 97 merchant ships constituting a total of 880,000 tons were ordered by foreign customers. The buyers came from Hong Kong, East Asian countries, the FRG, Norway, Singapore, the United States, Cuba, Australia etc. In 1986, the CSSC delivered new ships totalling 845,000 tons and 383 diesel motors together amounting to 544,000 hp.

Through our efforts in recent years, we have learned advanced technology and management techniques from foreign firms. At the present time, we are in a position to build vessels of all types to meet the needs of our clients and in accordance with international rules. In addition to export trade in ships and ship facilities, we place great emphasis on products of mechanical engineering and products unrelated to shipbuilding. The percentage of CSSC products

unrelated to shipbuilding in 1986 amounted to 28.5 percent of the total production value. At the present time, the CSSC employs 290,000 people. Of these, 42,000 are technicians and specialists. The arm of the CSSC that is responsible for foreign trade is the CSTC (China Shipbuilding Trading Company Ltd.) and COPECO (China Offshore Platform Engineering Corporation). The activities of CSTC and COPECO include:

- the export of merchant ships and marine vessels, ship facilities, mechanical engineering installations;
- the construction, including labor, of offshore platforms and various offshore facilities;
- the import of ship materials and shipping installations;
- transaction and organizational work for technological imports, joint production and cooperation with foreign firms for shipbuilding, ship design and the construction of installations;
- experimental work on ship models;
- design and technical consulting for ships and off-shore facilities;
- design and technical consulting for shipyards, harbors, factories, structural and civil engineering;
- repair and overhauling of ships and offshore platforms;
- general contractor and vendor for technical services for major projects;
- representation, service and repair of ship facilities and equipment of foreign companies.

The situation in the international shipbuilding market remains precarious. The domestic shipbuilding market and the strong demand for ships in China, however, represent a strong basis for the rapid development of the Chinese shipbuilding industry. For this reason, we are extremely interested in close collaboration with our friends, technical colleagues and customers in shipbuilding circles, shipping companies, banks and economic sectors in the FRG, Europe and the whole world. We believe that such cooperation will help to further the development of international shipping and offshore activities.

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MECHANICAL ENGINEERING FIRMS REFORM SYSTEM

Duesseldorf HANDELSBLATT in German 31 Mar 87 p 25

[Article by Volker Hansen: "Mechanical Engineering Firms Profit in Particular from Peking's Reform Policies"]

[Text] The economic reforms taking place in the PRC, which after successful experiments in agriculture have also included the industrial sector since 1978/79, aim at decentralization of decision-making, motivation of workers and a stress on market forces. This is not conceivable without help from abroad. Consequently, the open-door policy is an essential aspect of the reform movement, with its objective being to catch up with the pace of development in the West, in as far-reaching a way as possible, through technological imports. In order to achieve this goal, mechanical engineering firms and industrial construction companies in Western industrial countries are called upon to do their part to help move ahead the development of the Chinese economy.

The reform policies were first accompanied by a dramatic increase in investments, which, however, soon far overtaxed the absorbtion possibilities and existing budgetary resources. The investment stop which was imposed for this reason in 1981 particularly affected Western firms which contracted to build large industrial plants. In several readjustment phases, the Chinese government thereafter tried successfully to extend investments over a longer time period and to adapt them to existing resources. The insight that, in addition to the initially prioritized build-up of heavy industry, an efficient light industry with larger capacities and improved quality would have to be developed led necessarily to a policy of modernization for the more than 400,000 existing production units.

The mechanical and industrial engineering companies of Western industrial countries profit in particular as a result of the reforms and opening-up policy of China, which (on the basis of 1982) aims at doubling industrial and agricultural production by 1990 and at quadrupling these figures by the year 2000. Over the last ten years (1976-1985), the PRC purchased investment goods from these countries at an overall value of about DM 42 billion. Japanese companies led the field, with 42.4 percent, followed by manufacturers from the FRG with 16.8 percent and from the United States with 16.5 percent. These three countries accounted for a good 75 percent of machine imports. While purchases from Japan have been relatively stable since 1982 at a good 40 percent, the FRG's share has fluctuated over the past decade from 12 to 33 percent and that of the U.S.A. from 7 to 23 percent. The latest available data

from the year 1985 shows imports from Japan amounting to 40.7 percent, 20.2 percent from the U.S.A. and 16.5 percent from the FRG. Further down on the list in 1985 were Italy with 7.1. percent, Great Britain with 3.3 percent, France with 3.2 percent and Switzerland with 2.5 percent.

Fluctuations in the percentage of goods sold by various foreign countries were accompanied by fluctuations in the most important technological branches over a period of time; in the years following 1978, machine tools, mining equipment, machine-handling technology, office and information technology, textile machines, locomotives and in 1985 once again textile machines replaced each other as the most imported items.

The uncertainties that these fluctuations caused with regard to the evaluation of long-term business prospects were intensified by up-and-down jumps in deliveries over a period of time. While in monetary terms the deliveries of machines from Western industrialized countries dropped by more than half in 1982 as compared with the previous year, deliveries doubled in 1984 and 1985 (compared with the previous years, respectively). In 1985, the value of imports rose by a surprising 125 percent to over DM 14 billion.

Deliveries of German Machines to the PRC

Leading Sectors	1980	1981	1982	1983	1984	1985	1986
			in %				
Textile machines	8.2	5.1	9.4	18.4	21.8	25.1	22.1
Machine tools	7.8	4.5	5.3	7.1	8.8	11.5	15.6
Rubber & plastic machines	0.1	0.4	2.4	4.1	9.4	10.0	8.1
Food & packing machines	1.2	0.9	1.8	5.1	8.6	9.7	7.8
Metallurgical & milling equipment	0.1	8.3	20.6	3.3	2.1	5.3	7.5
General aeronautics	1.1	2.1	3.6	3.3	3.4	3.0	3.5
Construction equipment & machines for construction materials	3.6	2.1	2.5	3.9	3.0	4.6	2.9
Printing & paper machines	0.9	0.8	4.0	6.0	8.8	5.5	2.8
Mining machines	24.1	8.0	8.3	5.2	5.5	2.6	2.4
Handling technology	0.0	2.5	1.3	3.5	1.8	1.8	1.6
Engines	0.6	0.3	7.3	9.8	4.0	2.0	1.2
Other machines	52.3	65.0	33.5	30.3	22.7	18.9	24.5
Total Sales in million DM	1005	791	438	541	791	2372	3164

German Exports Subject to Fluctuations

Contracts for German mechanical engineering and construction developed in reaction to the international situation. The ups and downs of the past ten years ranged from DM 169 million in 1977 to over DM 1 billion in both 1979 and 1980. By 1982, deliveries had dropped off once again to DM 438 million, only to recover gradually to DM 791 million by 1984. After that point, exports shot up to DM 2.4 billion in 1985 and to DM 3.2 billion in 1986.

With this showing, the PRC holds ninth place as a customer for German mechanical and industrial engineering. This means that, for the first time, the USSR has fallen into second place. This "leap forward" is all the more remarkable as the PRC was in 31st place in 1983 as a customer for this sector, in 25th place in 1984 and in 11th place in 1985. The percentage of German machine exports all over the world thereby increased from 0.7 percent in 1983 to 3.3 percent last year. At the same time, the percentage of German machine exports in total German exports to the PRC increased from 20 to 51 percent, a result of the stated policy of Beijing to energetically pursue the industrialization of the country and the modernization of existing facilities by stepped-up imports of investment goods.

As in the international context, the most varied branches profited also in bilateral machine exports over time as a reaction to the priorities that had been set respectively. For example, in 1980 mining machines with one-fourth in 1980 and metallurgical works and rolling mills with one-fifth in 1982 accounted for of the total export of machines from the FRG, only thereafter to rapidly decline once again. Textile machines and machine tools increased their share during the last six years continually from 5 to 22 percent and 16 percent respectively in the first three quarters of 1986, while orders for engines and printing and paper machines increased from a percentage of less than 1 percent respectively in 1982 to 10 and 9 percent in the years 1983 and 1984, and have once again dropped to 1 and 3 percent, respectively.

The enormous increases in imports of 200 and 33 percent respectively, which occurred in both 1985 and 1986, will not be repeated in 1987. In a differentiated breakdown of the increases of the first quarter of 1985 with 82 percent to 360 percent in the third quarter (in comparison, respectively, with the corresponding period of the previous year) [sic]. Thereafter, the increases decline continually and reach the zero threshold in the fourth quarter of 1986. A considerable portion of the increases of the last two years result from the delivery of large orders for a good DM 2.3 billion, which were largely placed during the first half of 1985.

Sales Slump Can No Longer Be Ruled Out

The still outstanding deliveries of orders received in the area of large-scale construction projects will, together with those from last year, reach more than DM 600 million far into the current year and partially into 1988. However, it is doubtful whether they will produce additional increases in the sales of machines for the current year. It is more likely that a slump cannot be ruled out because of the imminent completion of the cited large orders. Exports would thereby even off at "normal levels."

Even after the student unrest that occurred around the beginning of the year, the determination of the Party and government to continue the reform policy remains;

a significant expansion in productivity in the PRC is the ultimate goal. This should open up good opportunities for mechanical and industrial engineering from abroad. However, since Chinese investment policy is largely influenced by the desire to equalize the foreign trade balance, the investment volume will be affected by the success of Chinese export efforts in obtaining at least some of the foreign currency needed for the purchase of investment goods by exporting the goods that China produces using this equipment.

The prospects of mechanical and industrial engineering as the largest German economic sector in the Chinese market are based not only on high levels of quality and technology, but also on the willingness of German mechanical engineers to offer customized solutions and, according to business strategy, when indicated to enter into cooperative agreements as a means of penetrating the market.

The German mechanical engineering companies benefit from a relationship that has existed for over thirty years with the PRC, which began within the framework of an economic agreement of the East Committee of German Commerce with the China Council for the Promotion of International Trade (CCPIT) in 1957, long before diplomatic relations were initiated. The further opening of China to the outside world will occur as a result of fear of one-sided dependence--as existed in the 1950's with regard to the USSR and to some extent with regard to Japan in the 1980's, as a balance is sought in relations with different regions of the world. For this reason as well, German mechanical and industrial engineering firms will continue to play a decisive role in building up Chinese industry, within the framework of China's contacts with Western Europe.

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CSO: 3620/201

MACHINE TOOL INDUSTRY ADVANCES DISCUSSED

Duesseldorf HANDELSBLATT in German 31 Mar 87 p 26

[Article by Ruediger Machetzki: "A Few Plants Produce Large Series Using Modern Technological Manufacturing Methods"]

China's machine tool and tool industry is the oldest branch of the Chinese mechanical engineering sector. This branch is characterized by two aspects. On the one hand, domestic production has stepped up and become increasingly diversified in recent years, and a series of new production units has been added. On the other hand, despite the important role that foreign trade plays in the Chinese economy, the involvement of this branch in foreign trade is relatively small.

This is true both in terms of import and export volume, as well as for technology transfer and economic cooperation agreements. The total imports of machine tools is at present (1985) hardly more than DM 120 million, and China's exports are at about DM 40 million. The latter category, however, is expected to increase during the course of the coming years, with the aim being to increase exports above all of forged machines and devices, lathes, milling machines, planing machines, drilling machines and machines for wood-processing. In view of the overall development in the Chinese machine tool industry, a significant expansion of present import levels cannot be expected in the next few years.

Chinese machine tool production underwent its first great expansion phase during the 1950's. At that time, a good 500 plants were gradually established for the manufacture of machines for cutting, forging, measuring instruments/fittings and grinding. During the 1980's, production capacity was further expanded to 937 plants, with an annual production value of about 5 billion yuan (DM 3 billion). The small output is explained by the fact that most of the operating units are small and mid-sized. There are only about 20 plants that are capable of modern manufacturing methods in large series production.

Even the production of these "key" enterprises is mostly technologically somewhat outdated. According to Chinese statistics, of a total of "155,000 product units produced" in 1985, only 2,000 had been manufactured via numerical control. Also according to Chinese statistics, there are only a few plants--including the Jinan Machine Tool Factories Nos. 1 and 2, the Beijing Machine Tool Factory No. 1 and the Quinghai Machine Tool Factory No. 1--, in which the

percentage of production value represented by products which were not yet manufactured in China during the 1970's is today at 30-50 percent.

This is also in keeping with the fact that the product quality of Chinese machine tools must be described as inadequate, in overall terms. To be sure, the percentage of products of "high quality" increased officially from 8 percent in 1981 to 27 percent in 1985, but turned around these figures mean that almost three-quarters of all products do not fully meet quality standards.

During the last five years, a total of 69 technology transfer projects were realized for the modernization of individual machine tool plants. With the exception of two projects for the Machine Tool Research Institute in Beijing (adoption of the GANUC 3, 5, 7 systems) and for the Jinan Machine Tool Factory No. 2 (Version 200 t machine press), these involved smaller projects. In addition, during the same time period cooperative agreements with a total value of over $10 million were concluded, with Japanese companies predominating. Technology transfer and cooperative agreements have up until now primarily involved the few large-scale plants (employing 2,000-6,000 people) that exist in China.

In terms of the user branches, the main areas of Chinese machine tool industry concern the extraction of raw materials, military-industrial manufacturing, mechanical engineering, transportation and motor vehicles as well as wood processing. In terms of the product range, metal cutting machines and tools with around 800 different types are in first place. Forging machines and forging tools comprise approximately 500 types, casting machines and casting equipment approximately 200, and machines and tools for wood-processing are in fourth place. With regard to the site locations, in addition to the previously-mentioned enterprises, the following plants might be mentioned in particular: Shanghai Machine Tool Factory No. 1 (planing machines and grinding machines), Kunming Machine Tool Factory (ground-boring and milling machines), Wuhan High-Performance Machine Tool Factory (high-performance measuring instruments, planers, drills, vertical machines, turning machines), Harbin Measuring and Cutting Tools Factory, Shenyang Machine Tool Factories Nos. 1 and 2 (drilling devices etc.), Nanjing Machine Tool Factory (turning machines), Zhengzhou Abrasive Materials Factory (grinding machines and grinding wheels), Qiqihar Machine Tool Factory No. 1 (shapers, high-speed drills, block cutting machines).

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CSO: 3620/201

XICHANG SATELLITE LAUNCH CENTER EXTENSION PROGRESSING

HK101606 Hong Kong ZHONGGUO XINWEN SHE in Chinese 1459 GMT 10 Apr 87

[Report by Xiao Longlian (5618 7893 5114)

[Text] Chengdu, 10 April (ZHONGGUO XINWEN SHE)--The extension project of China's satellite launch center in Xichang has been progressing rapidly. The construction of one of the principal parts of the project--the satellite testing shop--has been basically completed, and the construction of other supporting facilities are in full swing and expwcted to be brought into use by October.

The extension project of the Xicheng satellite launch center, which is designed to launch satellites for customers from the United States and other countries, was started in November last year.

The satellite testing shop, one of the three major supporting projects, is built on an area of over 6,000 square meters and is 25 meters high. It is built to meet very high construction qualitative standards--the cleanness standard alone is set at over 100,000-class--and the eight supporting facilities within the shop, including the freezing facility and defect checking room, are also designed to meet special requirements.

The expert in charge of this project told this reporter that the construction of this project is quite difficult because foreign customers have set high construction qualitative standards, and have made changes in construction drawings from time to time, adding an extra workload. Thanks to the persistent efforts of the personnel involved in this project, which has become the focus of world attention, the extension project is expected to be completed in time, and satellites will be launched for foreign customers as scheduled.

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CSO: 4010/42

REMOTE SENSING HELPS LAND RESOURCES SURVEY

OW071314 Beijing XINHUA in English 1226 GMT 7 May 87

[Text] Changsha, 7 May (XINHUA)—The Hunan Remote Sensing Center has completed experiments on land resources investigation using multi-platform remote sensing, the first ever conducted in China, a spokesman from the center announced today.

The experiments started in 1984 and covered 44,000 square km of land in central China's Hunan Province. During the experiments remote sensing was conducted at five altitudes: 705 km from the land satellite, 12 km and 3.5 km from the airplane, minimum altitude flight (under 1,000 km) and ground work, the spokesman said.

Images and data from the satellite and the airborne synthetic aperture side-looking radar helped experts to identify four prospective mineral deposits in the Nanling Mountains, in the south of the province. In Xiangxi, a newly developed sight-seeing area, data from remote sensing contributed to the analysis of the geological structure and tourism resources there.

"The most significant work was in the Dongting Lake area," said Liu Xia, chief engineer of the center. He said maps have been made based on images from the radar, greatly facilitating overall planning and all-round development of the area, which is Hunan's granary.

Liu also reported that an experiment was made in the lake area for monitoring floods with data and TV images transmitted over 100 km from the airborne radar and TV cameras to Changsha, capital of the province. The provincial authorities will set up a network for flood monitoring based on the experiments, he said.

Commenting on the experiments in Hunan, He Changchui, an official from China's State Remote Sensing Center, said that remote sensing in China is moving from the experimental stage to production service and it has become an important means of environmental and resources investigation.

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CSO: 4010/1023

ANTARCTIC EXPEDITION RESEARCH SHIP RETURNS

OW171428 Beijing XINHUA in English 1338 GMT 17 May 87

[Text] Qingdao, 17 May (XINHUA)--The ship "Polar" carrying China's Third Antarctic Expedition Team docked here today to end the largest ocean survey project.

The team told reporters that they have brought home three penguins and a couple of seals from the cold waters of the South Pole in addition to large amounts of research data and samples.

During the 199-day expedition Chinese scientists expanded the "Great Wall" Station on the Antarctic. They built more than 1,000 sq m of permament buildings, including a power generating block, a research block, a medicare, recreations and sports block, a terrestrial magnetism house, a kitchen and a garage.

Some 2,000 tons of equipment, fuel, food and other materials were unloaded off the ship into the station.

The team collected biological, hydrological, chemical and krill resource data on an area of 50,000 sq km of the waters surrounding the freezing continent, and they trial-caught krill with trawlnet there.

During their stay on the continent, they also conducted surveys on the weather, terrestrial magnetism, seismology, atmosphere, geology, environment, and glacier and mapped the landscape there.

The team proceeded to conduct China's first round-the-globe oceanographical survey. The ship sailed along routes in the Pacific, Atlantic and Indian Oceans, collecting large quantities of data and samples for the first time for China.

Fifteen scientists were left at the "Great Wall" Station to continue their winter surveys.

The team, composed of 126 scientists and crew, left the port city here on October 31 last year and arrived at the Antarctic Continent on December 27 through Pacific Ocean and via the Drake Passage.

The voyage covered 30,921 nautical miles (about 57,266 km). China sent its first team to the Antarctic in November of 1984 and set up the "Great Wall" Station on the continent. The second expedition went there a year later.

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CSO: 4010/1023

BRIEFS

CHINESE APPROACH TO SCIENCE CRITICIZED--The famous physicist Ding Zhaozhong [0002 5128 0022] said on a recent trip to China, "Chinese are very smart, but what is regrettable is that they do not emphasize experimental science. Natural science is an experimental science, and no theory can be divorced from experiment, so most of the inventions and creations in science during this century have been by Westerners, the contributions of Chinese have not been very great. The reason is this constant disregard for experiment. In my opinion, it is definitely not because of poverty or because of poor equipment, but rather the most important thing has been the problem of basic concepts." Ding Zhaozhong said, "Experimental science does not mean that you have to do it yourself, for those who do the work should be technicians. An experimental scientist should thoroughly understand theory, for only after he has thoroughly understood the theory can he come up with outstanding experimental results. The development of science has not been the minority submitting to the majority, but the majority submitting to the minority. This is to say that whoever discovers truth will determine who submits to whom. Chinese students are good at studies, but by memorizing books one can only memorize the things that have been discovered by others. It is insufficient to just be this way, for if it goes on for long, there cannot be development because there will not be work that is creative." [Text] [Beijing KEJI RIBAO in Chinese 4 Jan 87 p 4] 12586

UNSATISFACTORY USAGE OF S&T PERSONNEL--Over the past few months, the Shanghai Municipal Office of Personnel Affairs and the Office of Science and Technology Cadre hasve undertaken a survey of the situation regarding usage of more than 10,000 specialist technical personnel. The survey shows that at present 37.4 percent of specialist technical personnel in Shanghai can make the most of their function, 55.6 percent can partially fulfill their functions, and 6.8 percent cannot fulfill their functions at all. It may be inferred from the results of this survey that 19.8 percent of specialist technical personnel are in jobs not suited to their training or are in jobs not particularly suited to their training; although 16.5 percent are in suitable jobs or jobs that are mostly so, they are unsatisfied with their work; from the point of view workload, currently 25.2 percent of the people have no tasking or are not fully engaged, and one-third of specialist technical personnel in some units with a surplus of skilled personnel are being wasted due to the oversupply. There are many difficulties in the movement of skilled personnel in Shanghai. [Text] [Beijing KEJI RIBAO in Chinese 4 Jan 87 p 4] 12586

YUNNAN SCIENCE RESEARCH INSTITUTIONS--Beijing, 10 May (XINHUA)--Yunnan Province in southwest China has established more than 100 scientific research institutions in the past decade to bring the total to 153, reported today's PEOPLE'S DAILY. More than 10,000 researchers are engaged in the study of plants, animals, agriculture, forestry, animal husbandry, ecology, medicine, astronomy, geology, power, water control, machinery, metallurgy, textiles, chemicals, transportation, building materials, coal, posts and telecommunications. There were only three research institutions and about 30 researchers in Yunnan before the founding of new China in 1949. The 153 institutions are playing an important role in helping develop the local economy. For example, the province's institute of chemical engineering has conducted over 70 successful research items which brought about 40 million yuan in profit for local enterprises. [Text] [Beijing XINHUA in English 1340 GMT 10 May 87] /8309

TIANJIN TECHNOLOGICAL MARKET NETWORK--Tianjin, 10 May (XINHUA)--A network of technological markets with various channels and in diversified forms have taken shape in the north China industrial city of Tianjin. At present, the city has more than 240 trading firms of varying forms and its 18 districts and counties have set up various types of technical trading organizations. To strengthen its management over technological markets, the city started to register technical contracts last September and, by the end of last year, a total of 2,454 contracts had been registered. And another 1,392 technical contracts were registered in the first three months this year. Technological markets have begun to yield good returns. The municipal scientific and technological consultancy service company alone undertook some 1,100 consultancy items last year, involving a transaction volume of 8.6 million yuan. The prosperity of technological markets has fired the enthusiasm of research units for serving economic construction. Compared with 1983, the city's 27 units experimenting with the research set-ups last year undertook 85 percent more research topics, extended the technical transfer items by more than 30 times and increased their net income by 115 percent. By the end of 1986, the 27 research units created a total of over 370 million yuan of social benefit. [Text] [Beijing XINHUA in English 1439 GMT 10 May 87] /8309

TRANSMISSION LINES ACROSS RIVER--Beijing, May 12 (XINHUA)—China has, for the first time, used a helicopter to string power transmission lines across the Yangtze River in Anqing City, Anhui Province, today's PEOPLE'S DAILY reported. Two metal transmission line towers, on opposite sides of the river, are more than one and a half kilometers apart. The helicopter was used to bridge that gap with a power line. The transmission line will bring power generated at the Gezhouba Dam in Hubei Province to Shanghai, according to the report. A shipping blockade has been placed on the river until June 4 to ensure safety, the paper said. The power line between Gezhouba Dam and Shanghai is expected to go into operation this year, according to the paper. [Text] [Beijing XINHUA in English 0700 GMT 12 May 87 OW] /8309

TRAFFIC SAFETY RADAR INTRODUCED--To meet the demands to quickly turn around the urgent situation regarding highway traffic accidents, the model 644 hand-held traffic speed detection radar developed cooperatively by Plant 4150 of the Ministry of Electronics and the China College of Science and Technology was technically appraised in Beijing the other day. "Of every 10 accidents, 9 are because of excessive speed," and to prohibit speed violations this is an

important link in managing traffic safety. Successful development of the model 644 radar provides a modern tool of excellent performance for monitoring the speed of motor vehicle drivers on the highway. It operates over a long distance, is highly accurate in measuring speed, and is small in size, lightweight, low in energy consumption, and can be used in weather environments from -20 to +50 degrees Celsius. Its primary technical features have attained the advanced levels of similar products internationally of the early 1980's. The weight of this hand-held speed detection radar is only 1.4 kg, and is especially suitable for the suburbs and for flow monitoring. Because of its small size, when used for monitoring, it is not easily seen by the vehicle in question, which is useful for accurately apprehending speed violators. [Text] [Beijing BEIJING KEJIBAO in Chinese 5 Sep 86 p 2] 12586

CSO: 4008/1024

SINO-JAPANESE OPTICAL FIBER SEMINAR OPENS

OW121746 Beijing XINHUA in English 1453 GMT 12 May 87

[Text] Nanjing, 12 May (XINHUA)--A Sino-Japanese seminar on optical fibers and electromagnetic fields opened in Nanjing today.

The seminar is sponsored by the China Institute of Communications and two Japanese associations, and jointly-chaired by Ye Peida, honorary president of the Beijing Telecommunications College and Japanese professor Aoki Kazuo.

"China's research in optical fibers is developing rapidly," Ye said, adding long distance optical fiber communication is still being studied, while short distance lines have already been installed in many larger cities.

"Many Chinese universities and research institutes are currently involved in optical fiber research" Ye went on, "and some findings have already been applied in telecommunications, railways, and the petroleum, energy, nuclear and medical industries."

"Unfortunately, China's optical fiber theory and practice are five years behind the advanced world level," Ye said.

The two-day seminar will hear 150 scholars from China, Japan, the United States, Britain, and Australia who have submitted 140 papers.

Beijing hosted the First Sino-Japanese Optical Fiber and Electromagnetic Field Seminar in 1985.

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CSO: 4010/1021

KUNMING ECOLOGICAL INSTITUTE TO RESEARCH TROPICAL FORESTS

OW040956 Beijing XINHUA in English 0937 GMT 4 May 87

[Text] Kunming, 4 May (XINHUA)--The Kunming Ecological Institute, the first of its kind in China, will be doing research on how to better utilize China's tropical and subtropical forests.

Feng Yaozong, 55, director of the institute, which is affiliated with the Chinese Academy of Sciences, has cited Yunnan Province as the focus for the institute's research.

Yunnan's Xishuangbanna Prefecture, known as a "kingdom of animals," is the richest area in the country in biological resources, while the province's tropical forest, located further north than any other tropical forest on the face of the earth, has both a tropical and subtropical climate. Many researchers are interested in this forest because of its unique location.

"Yunnan Province, inhabited by over 20 ethnic minority groups, ranges from primitive to fully-developed areas, and because of its complexity, is a rich natural and social laboratory," Feng said.

According to Feng, the institute, staffed with 85 botanists, zoologists, and chemists, has set up research stations at 500 to 2,000 meters above sea level, and began collecting samples in 1980, when the institute was still in the talking stages.

"To create a community which simulates the natural environment, utilization, protection, ecology and economy must all be considered," Feng said.

In addition to collecting research data on the forests, over the past few years, scientists at the institute, have been working to create man-made tropical rain forests by using the complex information collected from existing forests, Feng went on.

Low temperatures have always hindered the development of China's rubber industry, and about 13,000 hectares of rubber trees in Xishuangbanna were hit by frost in the 1970's.

Feng and his colleagues, after years of exploration, have successfully created a community order which produces a warming, and prevents damage from the cold.

Feng distributed combined plantings, also known as ecotones, over a large area of Hainan Island in 1983, by planting rubber trees and tea bushes together. The tall rubber trees sheltered the tea from direct sunlight, and the tea bushes functioned like undergrowth.

Before introducing the ecotones, the island grew only rubber trees, and typhoons and low temperatures destroyed 10 billion plants annually.

"China now boasts the world's first experimental production base using ecotones to grow rubber and tea plants," Feng disclosed at a UN conference on tropical forests held last summer.

UNESCO plans to popularize Kunming's success in tropical forest research, and will host an international conference in Kunming next year.

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CSO: 4010/1021

KUNMING INSTITUTE GROUP STUDIES ETHNIC BOTANY

OW070810 Beijing XINHUA in English 0750 GMT 7 May 87

[Text] Kunming, 7 May (XINHUA)—The Kunming Institute of Botany of the Chinese Academy of Sciences has set up a body to study plants in the areas inhabited by minority ethnic groups, according to an institute spokesman.

Similar organizations in the United States, Britain and France specialize in studying traditionally utilized plants and medicinal materials used by minority ethnic groups, the spokesman said.

"Ethnic botany" is a new branch of science in which botanists study plants which play a role in economic and cultural activities and in the relations between the inhabitants of a particular place and the plants in that area, the spokesman said.

"Along with the advance of science and technology," he said, "scientists have realized that minority peoples' knowledge of the utilization of plants is often helpful in discovering new medicines, food and raw materials for industry."

China, a country inhabited by many nationalities, has 30,000 varieties of plants and 4,000 types of herbal medicines, which are found in the mountainous, forest and desert areas inhabited by ethnic minority groups, who have extensive collections of folklore relating to the nature, utilization and distribution of such plants, the spokesman said.

He said the new body will mainly research the location, history, origins and cultivation methods of medicinal plants, and the relationship between them and local economic and cultural development, he said.

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